User's Manual

Model DY
Vortex Flowmeter
Model DYA
Vortex Flow Converter
FOUNDATION Fieldbus Communication Type

digitalYEWFLO

FOUNDATION

IM 01F06F00-01EN

vigilantplant®

YOKOGAWA
Yokogawa Electric Corporation

IM 01F06F00-01EN
7th Edition

Model DY Vortex Flowmeter
Model DYA Vortex Flow Converter
FOUNDATION Fieldbus Communication Type

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1. INTRODUCTION

Thank you for purchasing FOUNDATION Fieldbus communication type of digitalYEWFLO vortex flowmeter.
To ensure correct use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

This manual describes only those topics that are required for operation of the FOUNDATION Fieldbus communication type.
For other topics, please refer to User's Manual for vortex flowmeter (IM 01F06A00-01EN). Regarding identical items, this manual has priority over IM 01F06A00-01EN.

■ Regarding This Manual

- This manual should be provided to the end user.
- The contents of this manual may be changed without prior notice.
- All rights are reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors or omissions are found, please inform Yokogawa.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instruments.
- Please note that this manual may not be revised for any specification changes, construction changes or operating part changes that are not considered to affect function or performance.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

■ Safety and Modification Precautions

- The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Yokogawa assumes no liability for the customer's failure to comply with these requirements. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.
- The following safety symbol marks are used in this manual and instrument.

WARNING

A WARNING sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death of personnel.

CAUTION

A CAUTION sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of the product.

IMPORTANT

An IMPORTANT sign denotes that attention is required to avoid damage to the instrument or system failure.

NOTE

A NOTE sign denotes information necessary for essential understanding of operation and features.

1.1 Using This Instrument Safety

(1) Installation

WARNING

- Installation of the vortex flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation.
- The vortex flowmeter must be installed within the specification conditions.
- The vortex flowmeter is a heavy instrument. Be careful that no damage is caused to personnel through accidentally dropping it, or by exerting excessive force on the vortex flowmeter. When moving the vortex flowmeter, always use a trolley and have at least two people carry it.
- When the vortex flowmeter is processing hot fluids, the instrument itself may become extremely hot. Take sufficient care not to get burnt.
- Where the fluid being processed is a toxic substance, avoid contact with the fluid and avoid inhaling any residual gas, even after the instrument has been taken off the piping line for maintenance and so forth.
- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- Do not apply excessive weight, for example, a person stepping on the vortex flowmeter.
- All procedures relating to installation must comply with the electrical code of the country where it is used.

(2) Wiring

WARNING

- The wiring of the vortex flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to wiring.
- When connecting the wiring, check that the supply voltage is within the range of the voltage specified for this instrument before connecting the power cable. In addition, check that no voltage is applied to the power cable before connecting the wiring.

(3) Operation

WARNING

- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- When opening the cover, wait for more than 3 minutes after turning off the power.

(4) Maintenance

WARNING

- Maintenance of the vortex flowmeter should be performed by the trained personnel having knowledge of safety standard. No operator shall be permitted to perform any operations relating to maintenance.
- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- When opening the cover, wait for more than 3 minutes after turning off the power.
- Always conform to maintenance procedures outlined in this manual. If necessary, contact Yokogawa.

(5) Explosion Protected Type Instrument

WARNING

- The instruments are products which have been certified as explosion proof type instruments. Strict limitations are applied to the structures, installation locations, external wiring work, maintenance and repairs, etc. of these instruments. Sufficient care must be taken, as any violation of the limitations may cause dangerous situations. Be sure to read Chapter 10 “EXPLOSION PROTECTED TYPE INSTRUMENT” before handling the instruments. For TIIS flameproof type instruments, be sure to read “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of manual for the vortex flowmeter (IM 01F06A00-01EN).
- Only trained persons use this instrument in the industrial location.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

1.2 Warranty

- The terms of this instrument that are guaranteed are described in the quotation. We will make any repairs that may become necessary during the guaranteed term free of charge.
- Please contact our sales office if this instrument requires repair.
- If the instrument is faulty, contact us with concrete details about the problem and the length of time it has been faulty, and state the model and serial number. We would appreciate the inclusion of drawings or additional information.
- The results of our examination will determine whether the meter will be repaired free of charge or on an at-cost basis.

■ The guarantee will not apply in the following cases:

- Damage due to negligence or insufficient maintenance on the part of the customer.
- Problems or damage resulting from handling, operation or storage that violates the intended use and specifications.
- Problems that result from using or performing maintenance on the instrument in a location that does not comply with the installation location specified by Yokogawa.
- Problems or damage resulting from repairs or modifications not performed by Yokogawa or someone authorized by Yokogawa.
- Problems or damage resulting from inappropriate reinstallation after delivery.
- Problems or damage resulting from disasters such as fires, earthquakes, storms, floods, or lightning strikes and external causes.

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1.3 ATEX Documentation

This is only applicable to the countries in European Union.

GB
All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

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Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

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2. AMPLIFIER FOR FIELDBUS COMMUNICATION

Refer to IM 01F06A00-01EN for the details of the amplifier. This section encompasses topics applicable to only the Fieldbus communication type.

(1) The Fieldbus communication type has no local key access function.
(2) The Fieldbus communication type has no BT200 (BRAIN TERMINAL) connection pin.
(3) The Fieldbus communication type has a simulation function. The SIMULATE_ENABLE switch is mounted on the amplifier. Refer to Section 7.3 “Simulation Function” for details of the simulation function.

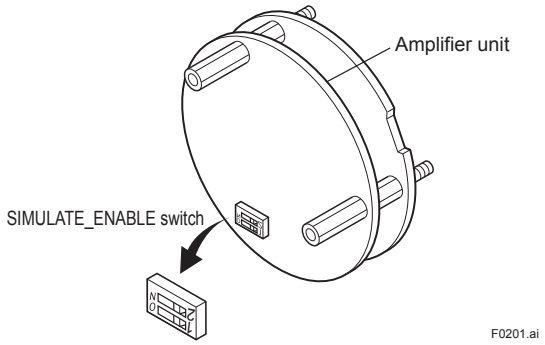


Figure 2.1 Amplifier for Fieldbus Communication

3. ABOUT FIELDBUS

3.1 Outline

Fieldbus is a bi-directional digital communication protocol for field devices, which offers an advancement in implementation technologies for process control systems and is widely employed by numerous field devices.
The Fieldbus communication type of the digitalYEWFLO employs the specification standardized by the Fieldbus FOUNDATION, and provides interoperability between Yokogawa devices and those produced by other manufacturers. Featuring two AI and two DI function blocks in each, the Fieldbus communication type's software enables a flexible instrumentation system to be implemented.
For information on other features, engineering, design, construction work, startup and maintenance of Fieldbus, refer to "Fieldbus Technical Information" (TI 38K03A01-01E).

3.2 Internal Structure of digitalYEWFLO

Each digitalYEWFLO contains two Virtual Field Devices (VFDs) that share the following functions.

3.2.1 System/Network Management VFD

- Sets node addresses and Physical Device tags (PD Tag) necessary for communication.
- Controls the execution of function blocks.
- Manages operation parameters and communication resources (Virtual Communication Relationship: VCR).

3.2.2 Function Block VFD

(1) Resource (RS) block

- Manages the status of digitalYEWFLO hardware.
- Automatically informs the host of any detected faults or other problems.

(2) Transducer (TR) block

- Converts the flow sensor output to the volumetric flow rate signal and transfers to an AI function block (AI1).
- With the option /MV
  - Converts temperature sensor output to the process fluid temperature and calculates the fluid density.
  - Calculates the mass flow rate from the fluid density thus obtained and the volumetric flow rate obtained with the flow sensor.
  - Transfers these calculation results to AI function blocks.
- Transfers limit switch signals to DI function blocks.

(3) AI function blocks (three)

- Output flowrate and temperature.
- Condition raw data from the TR block.
- Carry out scaling and damping (with a first-order lag), and allow input simulation.

(4) DI function blocks (two)

- Limit switches for the flow rate and temperature (option /MV).

(5) IT function block (one)

- Accumulate given values.

(6) AR function block (one)

- Calculate input values.

(7) PID function block (option /LC1)

- Performs the PID computation based on the deviation of the measured value from the setpoint.

3.3 Logical Structure of Each Block

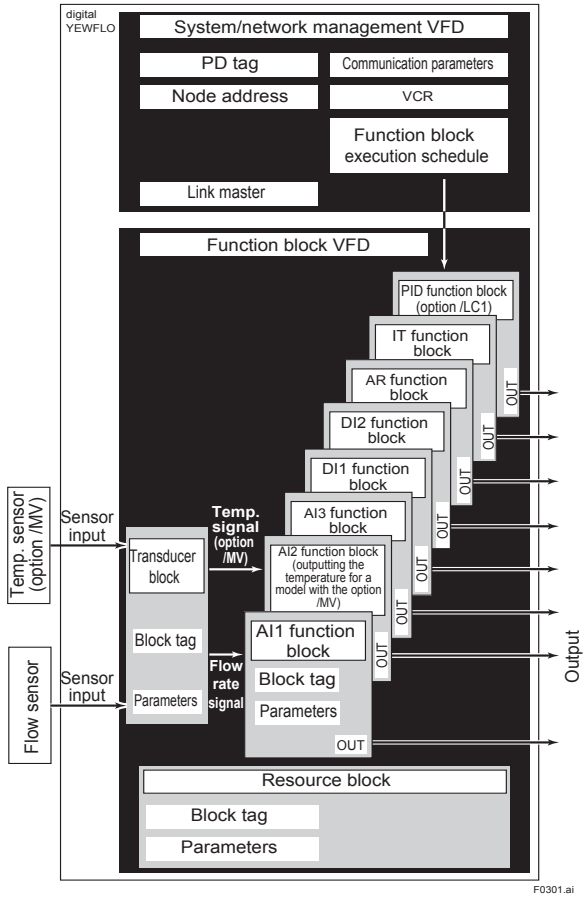


Figure 3.1 Logical Structure of Each Block

Various parameters, the node address, and the PD tag shown in Figure 3.1 must be set before using the device. Refer to Chapter 4 and onward for the setting procedures.

3.4 Wiring System Configuration

The number of devices that can be connected to a single bus and the cable length vary depending on system design. When constructing systems, both the basic and overall design must be carefully considered to achieve optimal performance.

4. GETTING STARTED

Fieldbus is fully dependent upon digital communication protocol and differs in operation from conventional 4 to 20 mA transmission and the BRAIN communication protocol. It is recommended that novice users use fieldbus devices in accordance with the procedures described in this section. The procedures assume that fieldbus devices will be set up on a bench or in an instrument shop.

4.1 Connection of Devices

The following instruments are required for use with Fieldbus devices:

- **Power supply:**

  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.

- **Terminator:**

  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices:**

  Connect your Fieldbus communication type digitalYEWFLO to a fieldbus. Two or more digitalYEWFLOs and other field devices can be connected. For the terminal assignment on the digitalYEWFLO, see Table 4.1.

Table 4.1 Terminal Connection for digitalYEWFLO

Terminal Symbols	Description
SUPPLY ⊕ SUPPLY ⊖	Fieldbus Communication Signal Terminals
⏚	Grounding Terminal

- **Host:**

  Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes. For operation of the host, refer to the instruction manual for each host. No other details on the host are given in this manual.

- **Cable:**

  Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K03A01-01E) for details of instrumentation cabling. For laboratory or other experimental use, a twisted pair cable two to three meters in length with a cross section of 0.9 mm^2 or more and a cycle period of within 5 cm (2 inches) may be used. Termination processing depends on the type of device being deployed. For the digitalYEWFLO, use terminal lugs applicable to M4 screw terminals. Some hosts require a connector.

Refer to Yokogawa when making arrangements to purchase the recommended equipment.
Connect the devices as shown in Figure 4.1.
Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.
The polarity of signal and power must be maintained.

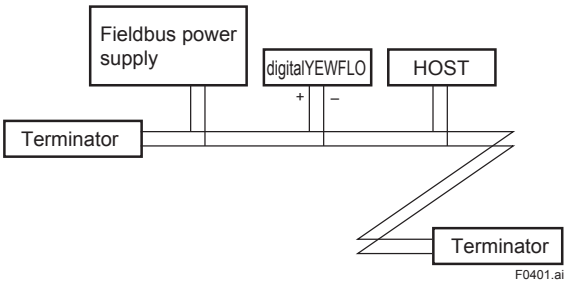


Figure 4.1 Device Connection

IMPORTANT

Connecting a Fieldbus configuration tool to a loop with its existing host may cause communication data scrambling resulting in a functional disorder or a system failure. Disconnect the relevant control loop from the bus if necessary.

4.2 Host Setting

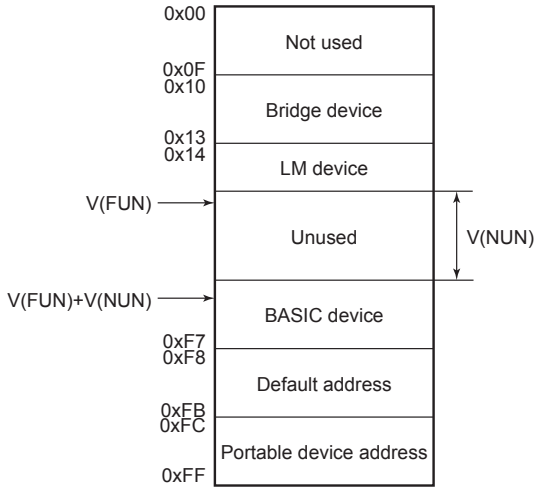
To activate Fieldbus, the following settings are required for the host.

IMPORTANT

Do not turn off the power immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for the improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the settings may return to the original values.

Table 4.2 Operation Parameters

Symbol	Parameter	Description and Settings
V (ST)	Slot-Time	Indicates the time necessary for immediate reply of the device. Unit of time is in octets (256 µs). Set maximum specification for all devices. For digitalYEWFLO, set a value of 4 or greater.
V (MID)	Minimum-Inter-PDU-Delay	Minimum value of communication data intervals. Unit of time is in octets (256 µs). Set the maximum specification for all devices. For digitalYEWFLO, set a value of 4 or greater.
V (MRD)	Maximum-Reply-Delay	The worst case time elapsed until a reply is recorded. The unit is Slot-time; set the value so that V (MRD) x V (ST) is the maximum value of the specification for all devices. For digitalYEWFLO, the setting must be a value of 12 or greater.
V (FUN)	First-Unpolled-Node	Indicate the address next to the address range used by the host. Set 0x15 or greater.
V (NUN)	Number-of-consecutive-Unpolled-Node	Unused address range.



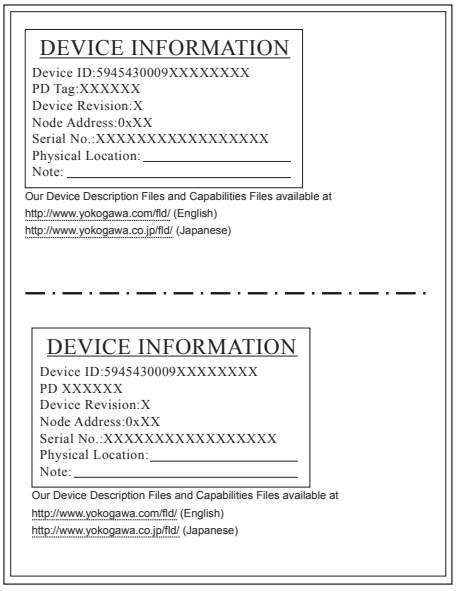
Note 1: LM device: with bus control function (Link Master function)
Note 2: BASIC device: without bus control function

F0402.ai

Figure 4.2 Available Address Range

4.3 Power-on of digitalYEWFLO and Bus

Turn on the power to the host, bus, and digitalYEWFLO. If any segments do not light, or if a current anomaly occurs, check the voltage of the power supply for the digitalYEWFLO.
The device information, including PD tag, Node address, and Device ID, is described on the sheet attached to digitalYEWFLO. The device information is given in duplicate on this sheet.
Using the host device display function, check that the digitalYEWFLO is in operation on the bus.



F0403.ai

Figure 4.3 Device Information Sheet Attached to digitalYEWFLO

Unless otherwise specified, the following settings are in effect when shipped from the factory.
If no digitalYEWFLO is detected, check the available address range. If the node address and PD Tag are not specified when ordering, default value is factory set. If two or more digitalYEWFLOs are connected at a time with default value, only one digitalYEWFLO will be detected from host as digitalYEWFLOs have the same initial address. Connect the digitalYEWFLOs one by one and set a unique address for each.

4.4 Integration of DD

If the host supports DD (Device Description), the DD of the digitalYEWFLO needs to be installed. Check if host has the following directory under its default DD directory.

594543 : the manufacturer number of Yokogawa Electric Corporation
└0009 : the device number of digitalYEWFLO

If this directory is not found, the DD for the digitalYEWFLO has not yet been installed. Create this directory and copy the DD files (0*m*0*n*.ffo and 0*m*0*n*.sym to be supplied separately where *m* and *n* are numerals) to it. If you do not have the DD files for the digitalYEWFLO, you can download them from our web site.
Visit the following web site.
http://www.yokogawa.com/fld/

Once the DD is installed in the directory, the name and attribute of all parameters of the digitalYEWFLO are displayed.

Off-line configuration is possible using the capabilities file.

NOTE

When using a capabilities file (CFF), make sure you use the right file for the intended device. The digitalYEWFLO is offered in two types in terms of capabilities:

- General type:
  AI function blocks (three), DI function blocks (two), AR function block (one), and IT function block (one).
- With the option /LC1: A PID function block

Using the wrong CFF file may result in an error when downloading the configured data to the device. Also, use the right DD files that accommodate the revision of the intended device.

4.5 Reading the Parameters

To read digitalYEWFLO parameters, select the AI block of the digitalYEWFLO from the host screen and read the OUT parameter. The current flow rate is displayed. Check that MODE_BLK of the function block and resource block is set to AUTO.

4.6 Continuous Record of Values

If the host has a function of continuously records the indications, use this function to list the indications (values). Depending on the host being used, it may be necessary to set the schedule of Publish (the function that transmits the indication on a periodic basis).

4.7 Generation of Alarm

If the host is allowed to receive alarms, generation of an alarm can be attempted from the digitalYEWFLO. In this case, set the reception of alarms on the host side. The digitalYEWFLO's VCR-7 is factory-set for this purpose. For practical purposes, all alarms are placed in a disabled status; for this reason, it is recommended that you first use one of these alarms on a trial basis. Set the value of link object-3 (index 30002) as "0, 299, 0, 6, 0". Refer to Subsection 5.6.1 "Link Objects" for details.
Since the LO_PRI parameter (index 4029) of the AI block is set to "0", try setting this value to "3". Select the Write function from the host in operation, specify an index or variable name, and write "3" to it.
The LO_LIM parameter (index 4030) of the AI block determines the limit at which the lower bound alarm for the process value is given. In usual cases, a very small value is set to this limit. Set smaller value than 100% value of XD_SCALE (same unit). Since the flow rate is almost 0, a lower bound alarm is raised. Check that the alarm can be received at the host. When the alarm is confirmed, transmission of the alarm is suspended.

5. CONFIGURATION

This chapter describes how to adapt the function and performance of the digitalYEWFLO to suit specific applications. Because multiple devices are connected to Fieldbus, it is important to carefully consider the device requirements and settings when configuring the system. The following steps must be taken.

(1) Network design

Determines the devices to be connected to Fieldbus and checks the capacity of the power supply.

(2) Network definition

Determines the PD tag and node addresses for all devices.

(3) Definition of combining function blocks

Determines how function blocks are combined.

(4) Setting tags and addresses

Sets the PD Tag and node addresses for each device.

(5) Communication setting

Sets the link between communication parameters and function blocks.

(6) Block setting

Sets the parameters for function blocks.

The following section describes in sequence each step of this procedure. The use of a dedicated configuration tool significantly simplifies this procedure. Refer to APPENDIX 7 “LINK MASTER FUNCTIONS” when the digitalYEWFLO is used as Link Master.

5.1 Network Design

Select the devices to be connected to the Fieldbus network. The following are essential for the operation of Fieldbus.

- **Power supply**

  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as power supply.

- **Terminator**

  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices**

  Connect the field devices necessary for instrumentation. The digitalYEWFLO has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, it is recommended that the devices used satisfy the requirements of the above test.

- **Host**

  Used for accessing field devices. A minimum of one device with bus control function is needed.

- **Cable**

  Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K03A01-01E) for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box as required.

First, check the capacity of the power supply. The power supply capacity must be greater than the sum of the maximum current consumed by all devices to be connected to Fieldbus. For the digitalYEWFLO, the maximum current (power supply voltage: 9 to 32 VDC) is 15 mA. The cable used for the spur must be of the minimum possible length.

5.2 Network Definition

Before connection of devices with Fieldbus, define the Fieldbus network. Allocate PD tags and node addresses to all devices (excluding such passive devices as terminators).
The PD tags are the same as conventional tag numbers assigned to devices. Up to 32 alphanumeric characters may be used for definition of the PD tag for each device. Use hyphens as delimiters as required.

The node addresses are used to locate devices for communication purposes. Since a PD tag is too long a data value, the host substitutes the node addressed for PD tags in communication. Node addresses can be set to numbers in a range of decimal 20 to 247 (hexadecimal 14 to F7). Assign devices having link master functionality (i.e., LM devices) from the smallest address number (0x14) in order, and other devices (i.e., basic devices) from the largest (0xF7). Assign an address in the range for basic devices to a digitalYEWFLO. Only when using a digitalYEWFLO with LM function as an LM device, assign an address in the range for LM devices to it. These address ranges are determined by the following parameters.

Table 5.1 Parameters for Setting Address Range

Symbol	Parameters	Description
V (FUN)	First-Unpolled-Node	Indicates the address next to the address range used for the host or other LM device.
V (NUN)	Number-of-consecutive-Unpolled-Node	Unused address range

Any devices within an address range written as “Unused” in Figure 5.1 cannot join the fieldbus. Other address ranges are periodically scanned to find any devices newly joining the fieldbus. Do not widen the available address ranges unnecessarily; the fieldbus communication performance may be severely degraded.

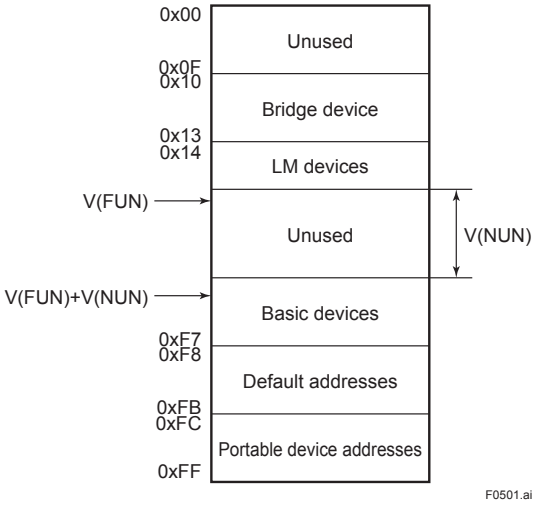


Figure 5.1 Available Range of Node Addresses

To ensure stable operation of Fieldbus, determine the operation parameters and set them to the LM devices. While the parameters in Table 5.2 are to be set, the worst-case value of all the devices to be connected to the same Fieldbus must be used. Refer to the specification of each device for details.

Table 5.2 Operation Parameter Values of digitalYEWFLO to be Set to LM Device

Symbol	Parameters	Description and Settings
V (ST)	Slot-Time	Indicates the time necessary for immediate reply of the device. Unit of time is in octets (256 µs). Set maximum specification for all devices. For a digitalYEWFLO, set a value of 4 or greater.
V (MID)	Minimum-Inter-PDU-Delay	Minimum value of communication data intervals. Unit of time is in octets (256 µs). Set the maximum specification for all devices. For a digitalYEWFLO, set a value of 4 or greater.
V (MRD)	Maximum-Response-Delay	The worst case time elapsed until a reply is recorded. The unit is Slot-time; set the value so that V (MRD) x V (ST) is the maximum value of the specification for all devices. For a digitalYEWFLO, value of V(MRD) x V (ST) must be 12 or greater.

5.3 Function Block Link Definitions

Link the input/output parameters of function blocks to each other as necessary. For a digitalYEWFLO, the output parameters of three AI blocks (OUTs), those of two DI blocks (OUT_Ds), input/output parameters of AR block, IT block and optional PID block (option /LC1) should be linked to parameters of different function blocks. Specifically, link settings must be written to the link object in the digitalYEWFLO. For details, refer to Section 5.6 “Block Setting.” It is also possible to read values from the host at appropriate intervals instead of linking the outputs of digitalYEWFLO’s function blocks to other blocks.
The linked blocks need to be executed synchronously with other blocks and the communication schedule. In this case, change the schedule of the digitalYEWFLO according to Table 5.3, in which factory settings are shown in parentheses.

Table 5.3 Function Block Execution Schedule of the digitalYEWFLO

Index	Parameters	Setting (Factory Setting in Parentheses)
269 (SM)	MACROCYCLE_ DURATION	Repetition period of control or measurement, i.e., macrocycle; to be set as a multiple of 1/32 ms (32000 = 1 second)
276 (SM)	FB_START_ENTRY.1	Start time of the AI1 block represented as the elapsed time from the start of each macrocycle; to be set as a multiple of 1/32 ms (0 = 0 ms)
277 (SM)	FB_START_ENTRY.2	Start time of the PID block (optional) represented as the elapsed time from the start of each macrocycle; to be set as a multiple of 1/32 ms (9600 = 300 ms)
278 (SM) to 289 (SM)	FB_START_ENTRY.3 to FB_START_ENTRY.14	Not set.

A maximum of 29 ms is taken for execution of each AI block. Arrange the communication schedule for an AI block's data that is to be transferred to its downstream block in such a way that it starts after a lapse of longer than 30 ms.
Figure 5.3 shows typical function block and communication schedules for the loop shown in Figure 5.2.

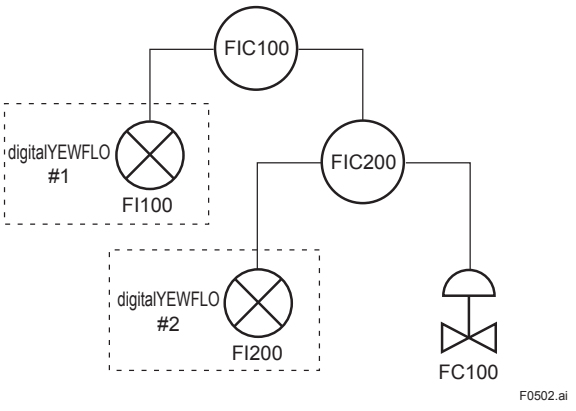


Figure 5.2 Example of Loop Connecting Function Blocks of Two digitalYEWFLOs with Other Devices

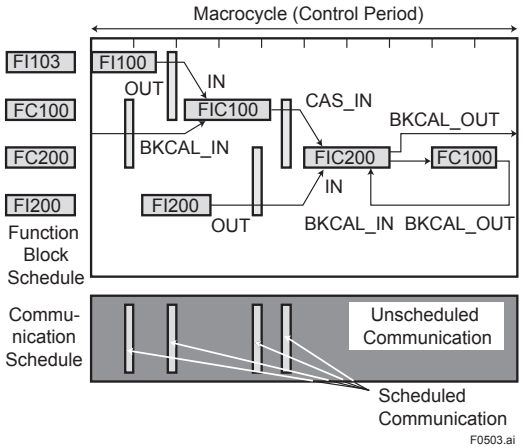


Figure 5.3 Function Block Schedule and Communication Schedule

When the control period (macrocycle) is set to more than 4 seconds, set the following interval to be more than 1% of the control period.

- Interval between "end of block execution" and "start of sending CD from LAS"
- Interval between "end of block execution" and "start of the next block execution"

5.4 Setting of Tags and Addresses

This section describes the steps in the procedure to set the PD tags and node address in the digitalYEWFLO. There are three states of Fieldbus devices as shown in Figure 5.4, and if the state is other than the lowest SM_OPERATIONAL state, no function block is executed. Whenever you have changed the PD tag or address of a digitalYEWFLO, transfer its state to SM_ OPERATIONAL.

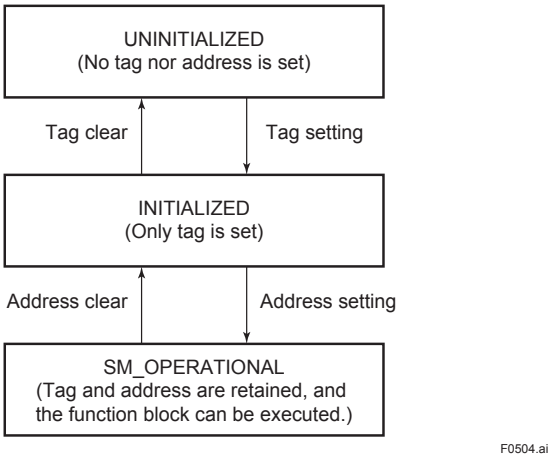


Figure 5.4 Status Transition by Setting PD Tag and Node Address

In each digitalYEWFLO, the PD tag and node address are set to “FT1003” and 242 (hexadecimal F2), respectively, before shipment from the factory unless otherwise specified. To change only the node address, clear the address once and then set a new node address. To set the PD tag, first clear the node address and clear the PD tag, then set the PD tag and node address again.
Devices whose node address have been cleared will await at the default address (randomly chosen from a range of 248 to 251, or from hexadecimal F8 to FB). At the same time, it is necessary to specify the device ID in order to correctly specify the device. The device ID of the YF100 is 5945430009xxxxxxxx. (The xxxxxxxx at the end of the above device ID is a total of 8 alphanumeric characters. Available characters are as follws.)

A B C D E F 0 1 2 3 4 5 6 7 8 9

5.5 Communication Setting

To set the communication function, it is necessary to change the database residing in SM (System Management)-VFD.

5.5.1 VCR Setting

Set VCR (Virtual Communication Relationship), which specifies the called party for communication and resources. Each digitalYEWFLO has 33 VCRs whose application can be changed, except for the first VCR, which is used for management.
Each digitalYEWFLO has VCRs of four types:

Server (QUB) VCR
: A server responds to requests from a host. This communication needs data exchange. This type of communication is called QUB (Queued User-triggered Bidirectional) VCR.

Source (QUU) VCR
: A source multicasts alarms or trends to other devices. This type of communication is called QUU (Queued User-triggered Unidirectional) VCR.

Publisher (BNU) VCR
: A publisher multicasts outputs of the AI blocks, DI blocks, AR block, IT block and PID block to other function blocks. This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.

Subscriber (BNU) VCR
: A subscriber receives output of another function block(s) by AR block, IT block and PID block.

Each VCR has the parameters listed in Table 5.4. Parameters must be changed together for each VCR because modification for each parameter may cause a contradiction.

Table 5.4 VCR Static Entry

Sub-index	Parameter	Description
1	FasArTypeAndRole	Indicates the type and role of communication (VCR). The following 4 types are used for the digitalYEWFLO. 0x32: Server (Responds to requests from host.) 0x44: Source (Transmits alarm or trend.) 0x66: Publisher (Sends AI, DI block output to other blocks.) 0x76: Subscriber (Receives output of other blocks by PID block.)
2	FasDllLocalAddr	Sets the local address to specify a VCR in the digitalYEWFLO. A range of 20 to F7 in hexadecimal.
3	FasDllConfigured RemoteAddr	Sets the node address of the called party for communication and the address (DLSAP or DLCEP) used to specify VCR in that address. For DLSAP or DLCEP, a range of 20 to F7 in hexadecimal is used. Addresses in Subindex 2 and 3 need to be set to the same contents of the VCR as the called party (local and remote are reversed).
4	FasDllSDAP	Specifies the quality of communication. Usually, one of the following types is set. 0x2B: Server 0x01: Source (Alert) 0x03: Source (Trend) 0x91: Publisher/Subscriber
5	FasDllMaxConfirm DelayOnConnect	To establish connection for communication, a maximum wait time for the called party's response is set in ms. Typical value is 60 seconds (60000).
6	FasDllMaxConfirm DelayOnData	For request of data, a maximum wait time for the called party's response is set in ms. Typical value is 60 secounds (60000).
7	FasDllMaxDlsduSize	Specifies maximum DL Service Data unit Size (DLSDU). Set 256 for Server and Trend VCR, and 64 for other VCRs.
8	FasDllResidual ActivitySupported	Specifies whether connection is monitored. Set TRUE (0xff) for Server. This parameter is not used for other communication.
9	FasDllTimelinessClass	Not used for the digitalYEWFLO.
10	FasDllPublisherTime WindowSize	Not used for the digitalYEWFLO.
11	FasDllPublisher SynchronizaingDlcep	Not used for the digitalYEWFLO.
12	FasDllSubscriberTime WindowSize	Not used for the digitalYEWFLO.
13	FasDllSubscriber SynchronizationDlcep	Not used for the digitalYEWFLO.
14	FmsVfdId	Sets VFD for the digitalYEWFLO to be used. (0x1: System/network management VFD 0x1234: Function block VFD)
15	FmsMaxOutstanding ServiceCalling	Set 0 to Server. It is not used for other applications.
16	FmsMaxOutstanding ServiceCalled	Set 1 to Server. It is not used for other applications.
17	FmsFeatures Supported	Indicates the type of services in the application layer. In the digitalYEWFLO, it is automatically set according to specific applications.

These 33 VCRs are factory-set as shown in Table 5.5.

Table 5.5 VCR List

Index (SM)	VCR Number	Factory Setting
293	1	For system management (Fixed)
294	2	Server (LocalAddr = 0xF3)
295	3	Server (LocalAddr = 0xF4)
296	4	Server (LocalAddr = 0xF7)
297	5	Trend Source (LocalAddr = 0x07, Remote Address=0x111)
298	6	Publisher (LocalAddr = 0x20)
299	7	Alert Source (LocalAddr = 0x07, Remote Address=0x110)
300	8	Server (LocalAddr = 0xF9)
301 to 325	9 to 33	Not set

5.5.2 Function Block Execution Control

According to the instructions given in Section 5.3 "Function Block Link Definitions", set the execution cycle of the function blocks and schedule of execution.

5.6 Block Setting

Set the parameter for function block VFD.

5.6.1 Link Objects

A link object combines the data voluntarily sent by the function block with the VCR. Each digitalYEWFLO has 40 link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 5.6. Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

Table 5.6 Link Object Parameters

Sub-index	Parameters	Description
1	LocalIndex	Sets the index of function block parameters to be combined; set "0" for Trend and Alert.
2	VcrNumber	Sets the index of VCR to be combined. If set to "0", this link object is not used.
3	RemoteIndex	Not used in the digitalYEWFLO. Set to "0".
4	ServiceOperation	Set one of the following. Set only one each for link object for Alert or Trend. 0: Undefined 2: Publisher 3: Subscriber 6: Alert 7: Trend
5	StaleCountLimit	Set the maximum number of consecutive stale input values which may be received before the input status is set to Bad. To avoid the unnecessary mode transition caused when the data is not correctly received by subscriber, set this parameter to "2" or more.

Link objects are not factory-set. Set link objects as shown in Table 5.7.

Table 5.7 Settings of Link Objects (example)

Index	Link Object #	Settings(example)
30000	1	AI. OUT → VCR#6
30001	2	Trend → VCR#5
30002	3	Alert → VCR#7
30003 to 30039	4 to 40	No used

5.6.2 Trend Objects

It is possible to make settings so that a function block automatically transmits the trend. For this, each digitalYEWFLO has ten trend objects: eight for trends of analog parameters and two for discrete parameters. For each trend object, specify a single parameter, the trend of which is to be transmitted. Each trend object has the parameters listed in Table 5.8. For the first four parameters, setting is mandatory. Before writing parameter settings to a trend object, parameter WRITE_LOCK of the resource block must be modified to unlock the write-lock.

Table 5.8 Parameters for Trend Objects

Sub-index	Parameters	Description
1	Block Index	Sets the leading index of the function block that takes a trend.
2	Parameter Relative Index	Sets the index of parameters taking a trend by a value relative to the beginning of the function block. In the digitalYEWFLO, the following three types of trends are possible. 7: PV 8: OUT 19: FIELD_VAL
3	Sample Type	Specifies how trends are taken. Choose one of the following 2 types: 1: Sampled upon execution of a function block. 2: The average value is sampled.
4	Sample Interval	Specifies sampling intervals in units of 1/32 ms. Set the integer multiple of the function block execution cycle.
5	Last Update	The last sampling time.
6 to 21	List of Status	Status part of a sampled parameter.
21 to 37	List of Samples	Data part of a sampled parameter.

Ten trend objects are not factory-set.

Table 5.9 Trend Objects

Index	Parameter	Factory Setting
32000 to 32007	TREND_FLT.1 to TREND_FLT.8	Not set.
32008	TREND_DIS.1	Not set (these parameters are used with a DI block or optional PID block).
32009	TREND_DIS.2	

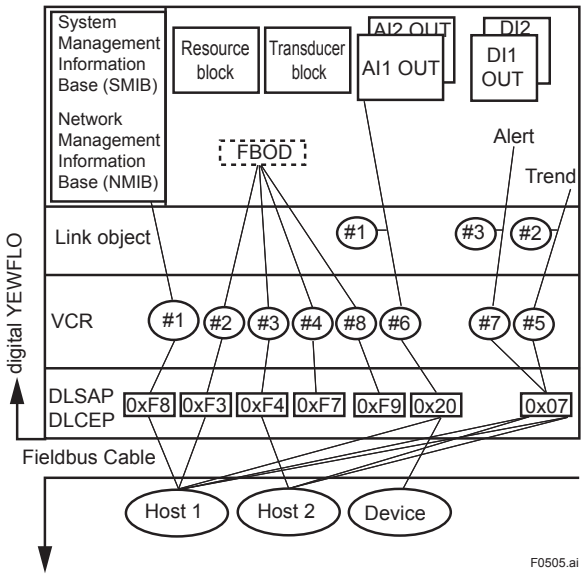


Figure 5.5 Example of Default Configuration

5.6.3 View Objects

View objects are used to group parameters. This reduces the load of data transactions. Each digitalYEWFLO supports four view objects for each of the Resource block, Transducer block, three AI blocks, two DI blocks, one IT block, one AR block, and PID block (option /LC1). Each view object contains a group of the parameters listed in Tables 5.11 to 5.17.

Table 5.10 Purpose of Each View Object

	Description
VIEW_1	Set of dynamic parameters required by operator for plant operation. (PV, SV, OUT, Mode etc.)
VIEW_2	Set of static parameters which need to be shown to plant operator at once. (Range etc.)
VIEW_3	Set of all the dynamic parameters.
VIEW_4	Set of static parameters for configuration or maintenance.

5.6.4 Function Block Parameters

Function block parameters can be read from the host or can be set. For details of the function blocks, refer to APPENDIX.

Table 5.11 View Objects for Resource Block

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3	VIEW_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				1
20	CYCLE_SEL		2		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		
24	FREE_SPACE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED_ROUT		4		
28	FAIL_SAFE	1		1	
29	SET_FSAFE				
30	CLR_FSAFE				
31	MAX_NOTIFY				4
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION				2
39	WRITE_PRI				1
40	WRITE_ALM				
41	ITK_VER				
42	SOFT_REV				
43	SOFT_DESC				
44	SIM_ENABLE_MSG				
45	DEVICE_STATUS_1			4	
46	DEVICE_STATUS_2			4	
47	DEVICE_STATUS_3			4	
48	DEVICE_STATUS_4			4	
49	DEVICE_STATUS_5			4	
50	DEVICE_STATUS_6			4	
51	DEVICE_STATUS_7			4	
52	DEVICE_STATUS_8			4	
53	SOFTDWN_PROTECT				1
54	SOFTDWN_FORMAT				1
55	SOFTDWN_COUNT				2
56	SOFTDWN_ACT_AREA			1	
57	SOFTDWN_MOD_REV			16	
58	SOFTDWN_ERROR			2	
	Total bytes	22	30	73	35

Table 5.12 View Objects for Transducer Block

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3 1st	VIEW_3 2nd	VIEW_3 3rd	VIEW_3 4th	VIEW_4 1st	VIEW_4 2nd	VIEW_4 3rd	VIEW_4 4th	VIEW_4 5th	VIEW_4 6th
1	ST_REV	2	2	2	2	2	2	2	2	2	2	2	2
2	TAG_DESC												
3	STRATEGY							2					
4	ALERT_KEY							1					
5	MODE_BLK	4		4									
6	BLOCK_ERR	2		2									
7	UPDATE_EVT												
8	BLOCK_ALM												
9	TRANSDUCER_ DIRECTORY												
10	TRANSDUCER_TYPE	2	2	2				2					
11	XD_ERROR	1		1									
12	COLLECTION_ DIRECTORY												
13	PRIMARY_VALUE_TYPE		2										
14	PRIMARY_VALUE	5		5									
15	PRIMARY_VALUE_ RANGE							11					
16	CAL_POINT_HI		4										
17	CAL_POINT_LO		4										
18	CAL_MIN_SPAN							4					
19	CAL_UNIT							2					
20	SENSOR_TYPE							2					
21	SENSOR_RANGE							11					
22	SENSOR_SN							4					
23	SENSOR_CAL_METHOD								2				
24	SENSOR_CAL_LOC								32				
25	SENSOR_CAL_DATE								7				
26	SENSOR_CAL_WHO								32				
27	LIN_TYPE							1					
28	SECONDARY_VALUE			5									
29	SECONDARY_VALUE_ UNIT							2					
30	PRIMARY_FTIME									4			
31	TERTIARY_VALUE			5									
32	TERTIARY_VALUE_UNIT									2			
33	LIMSW_1_VALUE_D										2		
34	LIMSW_1_TARGET										1		
35	LIMSW_1_SETPOINT										4		
36	LIMSW_1_ACT_ DIRECTION										1		
37	LIMSW_1_HYSTERESIS										4		
38	LIMSW_1_UNIT										2		
39	LIMSW_2_VALUE_D										2		
40	LIMSW_2_TARGET										1		
41	LIMSW_2_SETPOINT										4		
42	LIMSW_2_ACT_ DIRECTION										1		
43	LIMSW_2_HYSTERESIS										4		
44	LIMSW_2_UNIT										2		
45	ALARM_PERFORM		2										
46	ARITHMETIC_BLOCK		1							1			
47	SENSOR_STATUS		1							1			
48	FUNCTION		1							1			
49	FLUID_TYPE		1							1			

* Continued on next page

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3 1st	VIEW_3 2nd	VIEW_3 3rd	VIEW_3 4th	VIEW_4 1st	VIEW_4 2nd	VIEW_4 3rd	VIEW_4 4th	VIEW_4 5th	VIEW_4 6th
50	TEMP_UNIT		2							2			
51	PROCESS_TEMP		4							4			
52	BASE_TEMP		4							4			
53	DENSITY_UNIT		2							2			
54	PROCESS_DENSITY		4							4			
55	BASE_DENSITY		4								4		
56	PRESSURE_UNIT		2							2			
57	PROCESS_PRESSURE		4							4			
58	BASE_PRESSURE		4							4			
59	DEVIATION		4							4			
60	SECONDARY_FTIME										4		
61	CABLE_LENGTH										4		
62	FIRST_TEMP_COEF										4		
63	SECOND_TEMP_COEF										4		
64	SIZE_SELECT		1							1			
65	BODY_TYPE		1							1			
66	VORTEX_SENSOR_ TYPE		1							1			
67	K_FACTOR_UNIT		1							1			
68	K_FACTOR		4							4			
69	LOWCUT									4			
70	UPPER_DISPLAY_MODE											1	
71	LOWER_DISPLAY_MODE											1	
72	DISPLAY_CYCLE											1	
73	USER_ADJUST											4	
74	REYNOLDS_ADJUST											1	
75	VISCOSITY_VALUE											4	
76	GAS_EXPANSION_FACT											1	
77	FLOW_ADJUST											1	
78	FLOW_ADJ_ FREQUENCY											20	
79	FLOW_ADJ_DATA											20	
80	TLA_VALUE									4			
81	NOISE_BALANCE_MODE									1			
82	NOISE_RATIO			4						4			
83	SIGNAL_LEVEL									4			
84	FLOW_VELOCITY			4									
85	SPAN_VELOCITY			4									
86	VORTEX_FREQ			4									
87	SPAN_FREQ			4									
88	FLUID_DENSITY			4									
89	SENSOR_ERROR_ RECORD			2									
90	MODEL											32	
91	ALARM_SUM							8					
153	VOLUME_FLOW			5									
154	VOLUME_FLOW_UNIT							2					
	Total bytes	16	62	57	2	2	2	54	75	67	50	88	2

Table 5.13 View Objects for Each AI Function Block

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3	VIEW_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	OUT	5		5	
9	SIMULATE				
10	XD_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	L_TYPE				1
17	LOW_CUT				4
18	PV_FTIME				4
19	FIELD_VAL	5		5	
20	UPDATE_EVT				
21	BLOCK_ALM				
22	ALARM_SUM	8		8	
23	ACK_OPTION				2
24	ALARM_HYS				4
25	HI_HI_PRI				1
26	HI_HI_LIM				4
27	HI_PRI				1
28	HI_LIM				4
29	LO_PRI				1
30	LO_LIM				4
31	LO_LO_PRI				1
32	LO_LO_LIM				4
33	HI_HI_ALM				
34	HI_ALM				
35	LO_ALM				
36	LO_LO_ALM				
37	TOTAL			4	
38	TOTAL_START				
39	TOTAL_RATE_VAL				
40	TOTAL_RESET				
	Total bytes	31	26	35	46

Note: AI2 and AI3 blocks do not have parameters after index No. 37 (TOTAL) inclusive.

Table 5.14 View Objects for Each DI Function Block

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3	VIEW_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV_D	2		2	
8	OUT_D	2		2	
9	SIMULATE_D				
10	XD_STATE		2		
11	OUT_STATE		2		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	PV_FTIME				4
17	FIELD_VAL_D	2		2	
18	UPDATE_EVT				
19	BLOCK_ALM				
20	ALARM_SUM	8		8	
21	ACK_OPTION				2
22	DISC_PRI				1
23	DISC_LIM				1
24	DISC_ALM				
	Total bytes	22	8	22	19

Table 5.15 View Objects for PID Function Block (option /LC1)

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3	VIEW_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	PV_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	CONTROL_OPTS				2
14	STATUS_OPTS				2
15	IN			5	
16	PV_FTIME				4
17	BYPASS		1		
18	CAS_IN	5		5	
19	SP_RATE_DN				4
20	SP_RATE_UP				4
21	SP_HI_LIM		4		
22	SP_LO_LIM		4		
23	GAIN				4
24	RESET				4
25	BAL_TIME				4
26	RATE				4
27	BKCAL_IN			5	
28	OUT_HI_LIM		4		
29	OUT_LO_LIM		4		
30	BKCAL_HYS				4
31	BKCAL_OUT			5	
32	RCAS_IN			5	
33	ROUT_IN			5	
34	SHED_OPT				1
35	RCAS_OUT			5	
36	ROUT_OUT			5	
37	TRK_SCALE				11
38	TRK_IN_D	2		2	
39	TRK_VAL	5		5	
40	FF_VAL			5	
41	FF_SCALE				11
42	FF_GAIN				4
43	UPDATE_EVT				
44	BLOCK_ALM				
45	ALARM_SUM	8		8	
46	ACK_OPTION				2
47	ALARM_HYS				4
48	HI_HI_PRI				1
49	HI_HI_LIM				4
50	HI_PRI				1
51	HI_LIM				4
52	LO_PRI				1
53	LO_LIM				4
54	LO_LO_PRI				1
55	LO_LO_LIM				4
56	DV_HI_PRI				1
57	DV_HI_LIM				4
58	DV_LO_PRI				1
59	DV_LO_LIM				4
60	HI_HI_ALM				
61	HI_ALM				
62	LO_ALM				
63	LO_LO_ALM				
64	DV_HI_ALM				
65	DV_LO_ALM				
	Total bytes	43	43	83	104

Table 5.16 View Objects for Enhanced Arithmetic (AR) Block

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3	VIEW_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	OUT	5		5	
9	PRE_OUT	5		5	
10	PV_SCALE		11		
11	OUT_RANGE		11		
12	GRANT_DENY		2		
13	INPUT_OPTS				2
14	IN			5	
15	IN_LO			5	
16	IN_1			5	
17	IN_2			5	
18	IN_3			5	
19	RANGE_HI				4
20	RANGE_LO				4
21	BIAS_IN_1				4
22	GAIN_IN_1				4
23	BIAS_IN_2				4
24	BIAS_IN_2				4
25	BIAS_IN_3				4
26	BIAS_IN_3				4
27	COMP_HI_LIM				4
28	COMP_LO_LIM				4
29	ARITH_TYPE				1
30	BAL_TIME				4
31	BIAS				4
32	GAIN				4
33	OUT_HI_LIM				4
34	OUT_LO_LIM				4
35	UPDATE_EVT				
36	BLOCK_ALM				
37	AR_VOLUME_FLOW_UNIT				2
38	AR_TEMP_UNIT				2
39	AR_BASE_TEMP				4
40	AR_PRESSURE_UNIT				2
41	AR_BASE_PRESSURE				4
42	AR_DEVIATION				4
43	AR_DENSITY_UNIT				2
44	AR_BASE_DENSITY				4
45	AR_FIRST_TEMP_COEF				4
46	AR_SECOND_TEMP_COEF				4
47	AR_FLOW_CONFIG				
48	AR_DENSITY_FACTOR			5	
49	AR_DENSITY_FACTOR_UNIT				2
50	AR_CONFIG_SOFT_REV				
51	AR_CONFIG_DATE				
52	AR_CONFIG_WHO				
53	AR_CONFIG_STATUS				
54	AR_CONFIG_VSTRING32				
55	AR_CONFIG_VSTRING16				
56	AR_CONFIG_OSTRING32				
57	AR_CONFIG_OSTRING2				
	Total bytes	23	26	53	102

Table 5.17 View Objects for IT Function Block

Relative Index	Parameter Mnemonic	VIEW_1	VIEW_2	VIEW_3	VIEW_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	TOTAL_SP	4		4	
8	OUT	5		5	
9	OUT_RANGE		11		
10	GRANT_DENY		2		
11	STATUS_OPTS				2
12	IN_1	5		5	
13	IN_2	5		5	
14	OUT_TRIP	2		2	
15	OUT_PTRIP	2		2	
16	TIME_UNIT1		1		
17	TIME_UNIT2		1		
18	UNIT_CONV				4
19	PULSE_VAL1				4
20	PULSE_VAL2				4
21	REV_FLOW1	2		2	
22	REV_FLOW2	2		2	
23	RESET_IN	2		2	
24	STOTAL			4	
25	RTOTAL	4		4	
26	SRTOTAL			4	
27	SSP			4	
28	INTEG_TYPE				1
29	INTEG_OPTS				2
30	CLOCK_PER				4
31	PRE_TRIP				4
32	N_RESET	4		4	
33	PCT_INCL	4		4	
34	GOOD_LIM				4
35	UNCERT_LIM				4
36	OP_CMD_INT	1		1	
37	OUTAGE_LIM				4
38	RESET_CONFIRM	2		2	
39	UPDATE_EVT				
40	BLOCK_ALM				
41	ACCUM_TOTAL			4	
	Total bytes	52	17	68	42

Table 5.18 Indexes to View Objects for Each Block

Block	VIEW_1	VIEW_2	VIEW_3	VIEW_4
Resource block	40100	40101	40102	40103
Transducer block	40200	40201	40202 40203 40204 40205	40206 40207 40208 40209 40210 40211
AI1 function block	40400	40401	40402	40403
AI2 function block	40410	40411	40412	40413
DI1 function block	40600	40601	40602	40603
DI2 function block	40610	40611	40612	40613
PID function block (option /LCI)	40800	40801	40802	40803
Enhanced Arithmetic block	41750	41751	41752	41753
IT function block	41600	41601	41602	41603

6. EXPLANATION OF BASIC ITEMS

This chapter describes basic TR (Transducer block), AI, and DI function block parameter setting, displays of the integral indicator. For detailes of the function blocks, refer to APPENDIX.

This chapter contains information on how to adapt the function and performance of the digitalYEWFLO to suit specific applications. Because two or more devices are connected to FOUNDATION Fieldbus, settings including the requirements of all devices need to be determined. Practically, the following steps must be taken.

The following section describes each step of the procedure in the order given. Using a dedicated configuration tool allows the procedure to be significantly simplified. This section describes the procedure which has relatively simple functions.

6.1 Setting and Changing Parameters for the Whole Process

IMPORTANT

Do not turn off the power immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for an improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the setting may return to the original values.

Block mode

Many parameters require a change of the block mode of the function block to O/S (Out of Service) when their data is changed. To change the block mode of the function block, its MODE_BLK needs to be changed. The MODE_BLK is comprised of four sub-parameters below.

(1) Target (Target mode):
Sets the operating condition of the block.
(2) Actual (Actual mode):
Indicates the current operating condition.
(3) Permit (Permitted mode):
Indicates the operating condition that the block is allowed to take.
(4) Normal (Normal mode):
Indicates the operating condition that the block will usually take.

6.2 Transducer Block Parameters

The transducer block sets functions specific to the flow rate measurement of the digitalYEWFLO. For each block parameter in digitalYEWFLO, refer to APPENDIX 1 “LIST OF PARAMETERS FOR EACH BLOCK OF digitalYEWFLO.” The following describes important parameters and how to set them.
For the METHOD of TR block, refer to APPENDIX 10.1 “Transducer Block”.

(1) Mandatory Parameter Setting for Transducer Block

After setting parameters of the transducer block, set up XD_SCALE of the AI1 block (and of the AI2 block as appropriate).
Table 6.1 shows the parameters that must be set (in order of the relative index sequentially) depending on the operation conditions.

Table 6.1 Mandatory Parameter Setting for Transducer Block Depending on Operation Conditions

	Relative Index	Parameter Name								
Operation Conditions	47	SENSOR_ STATUS	1 = Standard	1 = Standard	2 = Built-in Temp. Sensor	2 = Built-in Temp. Sensor	2 = Built-in Temp. Sensor	2 = Built-in Temp. Sensor	2 = Built-in Temp. Sensor	2 = Built-in Temp. Sensor
	48	THERMOMETER_ FUNCTION	—	—	1 = Monitor only; or 6 = Not use	1 = Monitor only; or 6 = Not use	2 = Saturated steam	3 = Superheat steam	4 = GAS: STD/Normal	5 = LIQUID: Mass
	49	FLUID_TYPE	1 = LIQUID: Volume; 2 = GAS/ STEAM: Volume; 3 = LIQUID: Mass or 4 = GAS/ STEAM: Mass	5 = GAS: STD/Normal	1 = LIQUID: Volume; 2 = GAS/ STEAM: Volume; 3 = LIQUID: Mass or 4 = GAS/ STEAM: Mass	5 = GAS: STD/Normal	—	—	—	—
Mandatory	50	TEMPERATURE_ UNIT	✓	✓	✓	✓	✓	✓	✓	✓
	51	PROCESS_TEMP	✓	✓	✓	✓	✓	✓	✓	✓
	52	BASE_TEMP		✓		✓			✓	✓
	53	DENSITY_UNIT	✓	✓	✓	✓	✓	✓	✓	✓
	54	PROCESS_ DENSITY	✓	✓	✓	✓	✓	✓	✓	✓
	55	BASE_DENSITY								✓
	56	PRESSURE_ UNIT		✓		✓		✓	✓	
	57	PROCESS_ PRESSURE		✓		✓		✓	✓	
	58	BASE_ PRESSURE		✓		✓			✓	
	59	DEVIATION		✓		✓			✓	
	62	FIRST_TEMP_ COEF								✓
	63	SECOND_TEMP_ COEF								✓

(2) Explanations of Parameters

1) PRIMARY_VALUE_TYPE (Relative Index 13)
Indicates the type of the measured item represented by PRIMARY_VALUE. For the digitalYEWFLO, the value of PRIMARY_VALUE_TYPE is 100 and 101 as follows:
100 = Mass flow
101 = Volumetric flow
65535 = Other
Default: 101 (Volumetric flow)

2) PRIMARY_VALUE_FTIME (Relative Index 30)
Defines the damping time constant for the flow rate to be input to the flow rate calculation.
Setting range: 0 to 99 (seconds)
Default: 4 (seconds)

3) THERMOMETER_FUNCTION (Relative Index 48)
Determines the use of the temperature monitoring function for a model with the MV option.
1 = Monitor only
2 = Saturated steam
3 = Superheat steam
4 = Gas: STD/Normal
5 = LIQUID: Mass
6 = Not use
Default: 1 (= Monitor only)

4) FLUID_TYPE (Relative Index 49)
Selects the type of process fluid to be measured.
1 = LIQUID: Volume
2 = Gas/Steam: Volume
3 = LIQUID: Mass
4 = Gas/Steam: Mass
5 = Gas: Std/Normal
Default: 1 (= LIQUID: Volume)

5) TEMPERATURE_UNIT (Relative Index 50)
Selects the unit of temperature.
Setting range: 1001 (= °C), 1002 (= °F)
Default: 1001 (= °C)

6) PROCESS_TEMP (Relative Index 51)
Sets the normal operating temperature.
Setting range: -999.9 to 999.9
Unit: As selected in TEMP_UNIT
Default: 15.0

7) BASE_TEMP (Relative Index 52)
Sets the temperature under the standard conditions.
Setting range: -999.9 to 999.9
Unit: As selected in TEMP_UNIT
Default: 15.0

8) DENSITY_UNIT (Relative Index 53)
Selects the unit of density.
Setting range: 1097 (=kg/m^3)
Default: 1097 (= kg/m^3)

9) PROCESS_DENSITY (Relative Index 54)
Selects the density under the normal operating conditions.
Setting range: 0.00001 to 32000
Unit: As selected in DENSITY_UNIT
Default: 1024.0

10) BASE_DENSITY (Relative Index 55)
Sets the density under the standard conditions.
Setting range: 0.00001 to 32000
Unit: As selected in DENSITY_UNIT
Default: 1024.0

11) PRESSURE_UNIT (Relative Index 56)
Selects the unit of pressure.
Setting range: 1545 (= MPaa) or 1547 (= kPaa)
Default: 1545 (= MPaa)

12) PROCESS_PRESSURE (Relative Index 57)
Sets the absolute pressure under the normal operating conditions.
Setting range: 0.00001 to 32000
Unit: As selected in PRESSURE_UNIT
Default: 0.1013

13) BASE_PRESSURE (Relative Index 58)
Sets the absolute pressure under the standard conditions.
Setting range: 0.00001 to 32000
Unit: As selected in PRESSURE_UNIT
Default: 0.1013

14) DEVIATION (Relative Index 59)
Sets the deviation factor of the process fluid.
Setting range: 0.001 to 10.0
Default: 1.0 (nondimensional number)

15) SECONDARY_VALUE_FTIME (Relative Index 60)
Sets the damping factor for temperature measurement (for a model with the MV option).
Setting range: 0 to 99
Unit: s (seconds)
Default: 4 (seconds)

16) SIZE_SELECT (Relative Index 64)
Selects the flowmeter size.
Setting range:
1 = 15 mm (1/2 in.) 2 = 25 mm (1 in.)
3 = 40 mm (1.5 in.) 4 = 50 mm (2 in.)
5 = 80 mm (3 in.) 6 = 100 mm (4 in.)
7 = 150 mm (6 in.) 8 = 200 mm (8 in.)
9 = 250 mm (10 in.) 10 = 300 mm (12 in.)
11 = 400 mm (16 in.)
Default: 2 (= 25 mm (1 in.))

17) K_FACTOR_UNIT (Relative Index 67)
Selects the unit of the K factor.
Setting range: 1 (=p/L)
Default: 1 (=p/L).

18) K_FACTOR (Relative Index 68)
Sets the K factor of the combined detector at 15°C.
Setting range: 0.00001 to 32000
Unit: As selected in K_FACTOR_UNIT
Default: 68.6

19) LOW_CUT_FLOW (Relative Index 69)
Sets the low cutoff flow rate level.
Setting range: Minimum flow rate × 0.5 to XD_SCALE.EU_100
Unit: As selected in PRIMARY_VALUE_RANGE.Units Index
Default: Minimum gas flow rate for the size of 25 mm (1 in.)

20) UPPER_DISPLAY_MODE (Relative Index 70)
Selects the data to be displayed on the upper row of the LCD indicator, as follows:
1 = Flow Rate (%): Instantaneous flow rate as a percentage
2 = Flow Rate: Instantaneous flow rate in the specified unit
3 = Temperature (%): Temperature as a percentage (can only be selected for a model with the option /MV)
4 = Arithmetic Out: Output of AR block

21) LOWER_DISPLAY_MODE (Relative Index 71)
Selects the data to be displayed on the upper row of the LCD indicator, as follows:
1 = Blank
2 = Total: Totalized flow rate
3 = Temperature: Temperature (can only be selected for a model with the MV option)
4 = Integrator Out: Output of IT block

22) DISPLAY_CYCLE (Relative Index 72)
Sets the display refresh cycle of the LCD indicator, as a multiple of 500 milliseconds.
Setting range: 1 to 10 (= 500 ms to 5 s)
Default: 1 (= 500 ms)

6.3 AI Function Block Parameters

Parameters of the three AI function blocks can be read and written from the host.
AI1: Flow rate, AI2: Temperature, AI3: Volumetric flow rate for the use of mass flow rate calculation at AR function block. For each block parameter in digitalYEWFLO, refer to APPENDIX 1 “LIST OF PARAMETERS FOR EACH BLOCK OF digitalYEWFLO.” The following describes important parameters and how to set them.

MODE_BLK:

Indicates the three types of function block modes; Out_Of_Service, Manual, and Auto.
In Out_Of_Service mode, the AI block does not operate. The Manual mode does not allow values to be updated. The Auto mode causes the measured value to be updated. Under normal circumstances, set the Auto mode to take effect. The Auto mode is the factory default.

CHANNEL:

This is the parameter of the transducer block to be input to the AI block. AI1 block is assigned flow rate. AI2 block is assigned temperature. AI3 block is assigned volumetric flow rate for AR block.
This setting can not be changed.

XD_SCALE:

Scale of input from the transducer block. The maximum flow rate range in the registered sizing data is setting. “0” (0%), “10.000” (100%), and “m^3/h” for the unit are factory-set in case of UNCALIBRATION order. Changing the unit (can be set only in flow rate) also causes the unit within the transducer block to be automatically changed. (The unit is automatically changed according to the unit selected by AI1, AI2.) Units which can be set by XD_SCALE are shown in Table 6.2.
The setting range of the 100% scale (XD_SCALE.EU at 100) depends on the unit setting (XD_SCALE.Units Index) as shown in Table 6.3.

Table 6.2 Available Units

Item	Block	Available Units	
XD_ SCALE	AI1 (channel 1)	LIQUID: Mass GAS/STEAM: Mass	kg/s (1322), kg/min (1323), kg/h (1324), kg/d (1325), t/s (1326), t/min (1327), t/h (1328), t/d (1329), lb/s (1330), lb/min (1331), lb/h (1332), lb/d (1333)
		LIQUID: Volume GAS/STEAM: Volume	m^3/s (1347), m^3/min (1348), m^3/h (1349), m^3/d (1350), L/s (1351), L/min (1352), L/h (1353), L/d (1354), CFS [cf/s] (1356), CFM [cf/min] (1357), CFH [cf/h] (1358), ft3/d [cf/d] (1359), gal/s [USgal/s] (1362), GPM [USgal/min] (1363), gal/h [USgal/h] (1364), gal/d [USgal/d] (1365), ImpGal/s [UKgal/s] (1367), ImpGal/min [UKgal/min] (1368), ImpGal/h [UKgal/h] (1369), ImpGal/d [UKgal/d] (1370), bbl/s (1371), bbl/min (1372), bbl/h (1373), bbl/d (1374)
		GAS Std/Normal N: Normal S: Standard	SCFM [scf/min] (1360), SCFH [scf/h] (1361), Nm^3/s (1522), Nm^3/min (1523), Nm^3/h (1524), Nm^3/d (1525) Sm^3/s (1527), Sm^3/min (1528), Sm^3/h (1529), Sm^3/d (1530), NL/s (1532), NL/min (1533), NL/h (1534), NL/d (1535), SL/s (1537), SL/min (1538), SL/h (1539), SL/d (1540)
	AI2 (channel 2)	Temperature	°C (1001), °F (1002)
	AI3 (channel 5)	–	m^3/s (1347), m^3/min (1348), m^3/h (1349), m^3/d (1350), L/s (1351), L/min (1352), L/h (1353), L/d (1354), CFS [cf/s] (1356), CFM [cf/min] (1357), CFH [cf/h] (1358), ft3/d [cf/d] (1359), gal/s [USgal/s] (1362), GPM [USgal/min] (1363), gal/h [USgal/h] (1364), gal/d [USgal/d] (1365), ImpGal/s [UKgal/s] (1367), ImpGal/min [UKgal/min] (1368), ImpGal/h [UKgal/h] (1369), ImpGal/d [UKgal/d] (1370), bbl/s (1371), bbl/min (1372), bbl/h (1373), bbl/d (1374)

Note: With the same setting, some units are represented differently between the FOUNDATION Fieldbus communication type and the HART or BRAIN communication type of a digitalYEWFLO. Each unit enclosed in brackets above shows the unit for the HART or BRAIN communication type of a digitalYEWFLO, corresponding to the preceding unit (for the FOUNDATION Fieldbus communication type).

Table 6.3 Setting Range of EU at 100 of XD_ SCALE Depending on Unit

Block	Unit Selected	Setting Range of EU at 100
AI1	Refer to Table 6.2	above 0.0
AI2	°C °F	–273.15 to 999.9 –459.67 to 999.9
AI3	Refer to Table 6.2	above 0.0

OUT_SCALE:

Sets the range of output (from 0% to 100%). Available units for OUT_SCALE are the same as units for XD_SCALE in Table 6.2 and percentage.

L_TYPE:

Specifies the operation function of the AI1 block. The factory default is “Direct”, so the input delivered to CHANNEL is directly reflected on OUT. If set to “Indirect”, scaling by XD_SCALE and OUT_SCALE is carried out and is reflected on OUT. “Indirect SQRT” is not used for a digitalYEWFLO.

PV_FTIME:

Sets the time constant of the damping function within AI block (primary delay) in seconds.

Alarm Priority:

Indicates the priority of the process alarm. If a value of 3 or greater is set, an alarm is transmitted. The factory default is 0. Four types of alarm can be set: HI_PRI, HI_HI_PRI, LO_PRI, and LO_LO_PRI.

Alarm Threshold:

Sets the threshold at which a process alarm is generated. The factory default setting is a value that does not generate an alarm. Four types of alarm can be set: HI_LIM, HI_HI_LIM, LO_LIM, and LO_LO_LIM.

6.4 Parameters of DI Function Block

DI function blocks work based on the limit switch signals generated by the transducer block where DI1 is based on those signals on the flow rate and DI2 on the temperature (with the option /MV).

MODE_BLK

Supports O/S, Auto, and Manual modes. The DI block does not function in the O/S mode, does not update the measured value in the Manual mode, and updates the measured value in the Auto mode. Normally, set the mode to Auto. Before the digitalYEWFLO is shipped from the factory, all the DI blocks are set to O/S mode.

CHANNEL

Selects the input to the DI block from the transducer. CHANNEL is always set to 3 or 4 for a digitalYEWFLO.

PV_FTIME

Stipulates the delay time (in seconds) of changing the output value after a change of the value inside the DI block.

DISC_PRI

Determines the priority level of the discrete alarm on the block's output (OUT_D). The alarm will be transmitted upon occurrence only when the DISC_PRI is set at 3 or higher. This parameter is set to 1 before the digitalYEWFLO is shipped from the factory.

Table 6.4 Alarm Priority

Value	Descriptions
0	Alart is not notified. Alarm parameters are not updated.
1	Alart is not notified.
3 to 7	Advisory alarms.
8 to 15	Critical alarms.

DISC_LIM

Setpoint of the discrete alarm; when the value of OUT_D agrees with the value set in DISC_LIM, the discrete alarm is generated

6.5 Integral LCD Indicator

The display items are as follows.

Table 6.5 Display Items

Display Items	Upper Display Mode AI1 Flowrate% Flowrate AI2 Temperature% AR Arithmetic OUT
	Lower Display Mode Blank AI1 Total AI2 Temperature IT Integrator OUT

The display items can be made by selecting in Upper/Lower Display mode.
The contents of each display items are as follows.
(1)Flowrate%, Temperature%
(2)Flowrate
(3)Total
(4)Temperature
(5)Arithmetic OUT
Display Value=Display AR OUT Vale.
(by setting AROUT_RANG)
Display unit=Display the setting value of AR OUT_RANGE. Units Index.
Available display units are as follows.

Volumetric Flow Rate
m^3/s(1347), m^3/min(1348), m^3/h(1349), m^3/d(1350), L/s(1351), L/min(1352), L/h(1353), L/d(1354), CFS(1356), CFM(1357), CFH(1358), ft^3/d(1359), gal/s(1362), GPM(1363), gal/h(1364), gal/d(1365), ImpGal/s(1367), ImpGal/min(1368), ImpGal/h(1369), ImpGal/d(1370), bbl/s(1371), bbl/min(1372), bbl/h(1373), bbl/d(1374)

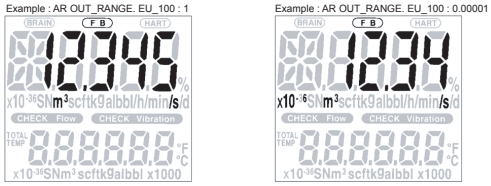
Mass Flow Rate
kg/s(1322), kg/min(1323), kg/h(1324), kg/d(1325), t/s(1326), t/min(1327), t/h(1328), t/d(1329), lb/s(1330), lb/min(1331), lb/h(1332), lb/d(1333)

Voluemetric Flow Rate at Normal Condition
Nm^3/s(1522), Nm^3/m(1523), Nm^3/h(1524),
Nm^3/d(1525), NL/s(1532), NL/m(1533),
NL/h(1534), NL/d(1535), Sm^3/s(1527),
Sm^3/m(1528), Sm^3/h(1529), Sm^3/d(1530),
SL/s(1537), SL/m(1538), SL/h(1539),
SL/d(1540), SCFM(1360), SCFH(1361)
N: Normal, S: Standard.

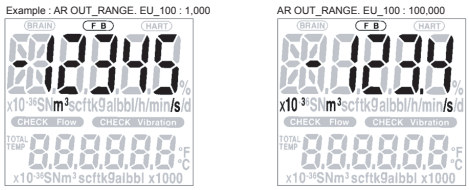
Percentage
%(1342)

(1) Display Style

In case of plus display

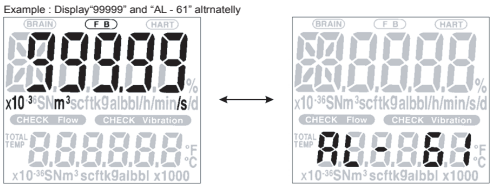


In case of Minus display

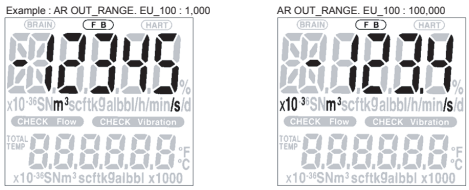


(2) Alarm Display

In case of plus display



In case of Minus display



7. IN-PROCESS OPERATION

This chapter describes the procedure performed when changing the operation of the function block of the digitalYEWFLO in process.

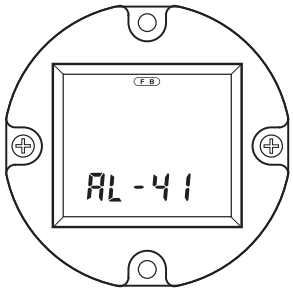
7.1 Mode Transition

When the function block mode is changed to Out_ Of_Service, the function block pauses and a block alarm is issued.
When the function block mode is changed to Manual, the function block suspends updating of output values. In this case alone, it is possible to write a value to the OUT parameter of the block for output. Note that no parameter status can be changed.

7.2 Generation of Alarm

7.2.1 Indication of Alarm

When the self-diagnostics function indicates that a device is faulty, an alarm (device alarm) is issued from the resource block. When an error (block error) is detected in each function block or an error in the process value (process alarm) is detected, an alarm is issued from each block. If an LCD indicator is installed, the error number is displayed as AL-XX. If two or more alarms are issued, multiple error numbers are displayed in 2-second intervals. (when "1" is set to DISPLAY_CYCLE).



F0701.ai

Figure 7.1 Error Identification on Indicator

The error details corresponding to alarm indications on the LCD indicator and whether or not switches are provided to disable the corresponding alarms are shown in Table 7.1. For the alarms for which an alarm mask switch is provided, the default alarm settings are also shown. Those alarms for which an alarm mask switch is not provided are enabled at all times. For how to modify these mask switch statuses, refer to APPENDIX 3 "OPERATION OF EACH PARAMETER IN FAILURE MODE."

Table 7.1 Alarm Indications and Alarm Mask Switches

LCD	Error Detail	Alarm Mask SW (default)
AL-01	The EEPROM(S) failed.	Not provided
AL-02	The serial communication circuit in the amplifier failed (type 1 error).	Not provided
AL-03	The serial communication circuit in the amplifier failed (type 2 error).	Not provided
AL-04	The EEPROM(F) failed.	Not provided
AL-05	The flow sensor failed.	Provided (ON)
AL-06	The input circuit in the amplifier failed.	Provided (ON) *
AL-07	The temperature circuit in the amplifier failed.	Not provided
AL-08	The temperature sensor failed.	Not provided
AL-20	No function blocks are scheduled.	Not provided
AL-21	Resource Block is in O/S mode.	Not provided
AL-22	Transducer Block is in O/S mode.	Not provided
AL-23	AI1 Block is in O/S mode.	Provided (ON)
AL-24	AI2 Block is in O/S mode.	Provided (OFF)
AL-25	DI1 Block is in O/S mode.	Provided (OFF)
AL-26	DI2 Block is in O/S mode.	Provided (OFF)
AL-27	PID Block is in O/S mode.	Provided (OFF)
AL-28	AI3 Block is in O/S mode.	Provided (OFF)
AL-29	IT Block is in O/S mode.	Provided (OFF)
AL-30	AR Block is in O/S mode.	Provided (OFF)
AL-41	Flow rate is over the range.	Not provided
AL-42	The flow rate span setting exceeds the range limit.	Not provided
AL-43	Temperature is over the range. (Regulated in the upper or lower limit value)	Not provided
AL-51	The transient vibration makes the current flow rate output constant.	Provided (OFF)
AL-52	The high vibration makes the current flow rate output zero.	Provided (OFF)
AL-53	The shedder bar is clogged with a material.	Provided (OFF)
AL-54	The current flow rate is fluctuating more than 20%.	Provided (OFF)
AL-61	Indicator is over the range.	Not provided
AL-62	AI1 Block is in Manual mode.	Provided (ON)
AL-63	AI1 Block is in simulation mode.	Provided (ON)
AL-64	AI1 Block is not scheduled.	Provided (ON)
AL-65	AI2 Block is in Manual mode.	Provided (OFF)
AL-66	AI2 Block is in simulation mode.	Provided (OFF)
AL-67	AI2 Block is not scheduled.	Provided (OFF)
AL-68	DI1 Block is in Manual mode.	Provided (OFF)
AL-69	DI1 Block is in simulation mode.	Provided (OFF)
AL-70	DI1 Block is not scheduled.	Provided (OFF)
AL-71	DI2 Block is in Manual mode.	Provided (OFF)
AL-72	DI2 Block is in simulation mode.	Provided (OFF)
AL-73	DI2 Block is not scheduled.	Provided (OFF)
AL-74	PID Block is in Bypass mode.	Provided (OFF)
AL-75	PID Block is failed (type 1 error).	Provided (OFF)
AL-76	PID Block is failed (type 2 error).	Provided (OFF)
AL-77	AI3 Block is in Manual mode.	Provided (OFF)
AL-78	AI3 Block is in simulation mode.	Provided (OFF)
AL-79	AI3 Block is not scheduled.	Provided (OFF)
AL-80	IT Block is in Manual mode.	Provided (OFF)
AL-81	IT Block is not scheduled.	Provided (OFF)
AL-82	IT Total backup failed. Last IT Output.Value (IT. OUT.Value) could not saved.	Provided (OFF)
AL-83	IT Clock Period (IT.CLOCK_PER) is smaller than IT Period of Execution(IT.EXECUTION_ PERIOD).	Provided (OFF)
AL-84	AR Block is in Manual mode.	Provided (OFF)
AL-85	AR Block is not scheduled.	Provided (OFF)
AL-86	AR Range High (AR.RANGE_HI) is smaller than AR Range Low (AR.RANGE_LOW).	Provided (OFF)
AL-87	AR Input1 (AR.IN_1) is over range.	Provided (OFF)
AL-88	AR Input2 (AR.IN_2) is over range.	Provided (OFF)
AL-89	AR Input (AR.IN) is not connected to the volumetric flow.	Provided (OFF)
AL-90	AR Input1 (AR.IN_1) is not connected to the temperature.	Provided (OFF)
AL-91	AR Input2 (AR.IN_2) is not connected to the pressure.	Provided (OFF)
AL-92	AR Compensation Coefficient (AR. AR_FLOW_CONFIG.Element) changed unexpected. Therefore AR Output (AR.OUT.Value) is uncertainty.	Provided (OFF)
AL-93	AR Output Range .Units Index (AR.OUT_ RANGE.Unit Index) is not selected rightly the corresponding to AR Arithmetic Type (AR. ARITH_TYPE).	Provided (OFF)

*: Not provided for a model with the option /MV and with the fluid density calculation set to be active.

7.2.2 Alarms and Events

Each digitalYEWFLO can report the following alarms and events as alerts.

Analog Alerts (Generated when a process value exceeds threshold)
- By AI Block: Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm

Discrete Alerts (Generated when an abnormal condition is detected)
- By Resource Block: Block Alarm, Write Alarm
- By Transducer Block: Block Alarm
- By AI Block: Block Alarm
- By PID Block: Block Alarm

Update Alerts (Generated when a important (restorable) parameter is updated)
- By Resource Block: Update Event
- By Transducer Block: Update Event
- By AI Block: Update Event
- By PID Block: Update Event

An alert has the following structure:

Table 7.2 Alert Object

Subindex			Parameter Name	Explanation
Analog Alert	Discrete Alert	Update Alert		
1	1	1	Block Index	Index of block from which alert is generated
2	2	2	Alert Key	Alert Key copied from the block
3	3	3	Standard Type	Type of the alert
4	4	4	Mfr Type	Alert Name identified by manufacturer specific DD
5	5	5	Message Type	Reason of alert notification
6	6	6	Priority	Priority of the alarm
7	7	7	Time Stamp	Time when this alert is first detected
8	8		Subcode	Enumerated cause of this alert
9	9		Value	Value of referenced data
10	10		Relative Index	Relative Index of referenced data
		8	Static Revision	Value of static revision (ST_REV) of the block
11	11	9	Unit Index	Unit code of referenced data

7.3 Simulation Function

The simulation function simulates the input of a function block and lets it operate as if the data was received from the transducer block. It is possible to conduct testing for the downstream function blocks or alarm processes.

A SIMULATE_ENABLE jumper switch is mounted on the digitalYEWFLO's amplifier. This is to prevent the accidental operation of this function. When this is switched on, simulation is enabled. (Refer to Figure 7.2.) To initiate the same action from a remote terminal, if REMOTE LOOP TEST SWITCH is written to SIM_ENABLE_MSG (index 1044) parameter of the resource block, the resulting action is the same as is taken when the above switch is on. Note that this parameter value is lost when the power is turned off. In simulation enabled status, an alarm is generated from the resource block, and other device alarms will be masked; for this reason the simulation must be disabled immediately after using this function.

The SIMULATE parameter of AI block consists of the elements listed in Table 7.3 below.

Table 7.3 SIMULATE Parameter

Sub-index	Parameters	Description
1	Simulate Status	Sets the data status to be simulated.
2	Simulate Value	Sets the value of the data to be simulated.
3	Transducer Status	Displays the data status from the transducer block. It cannot be changed.
4	Transducer Value	Displays the data value from the transducer block. It cannot be changed.
5	Simulate En/Disable	Controls the simulation function of this block. 1: Disabled (standard) 2: Active(simulation)

When Simulate En/Disable in Table 7.3 above is set to "Active", the applicable function block uses the simulation value set in this parameter instead of the data from the transducer block. This setting can be used for propagation of the status to the trailing blocks, generation of a process alarm, and as an operation test for trailing blocks.

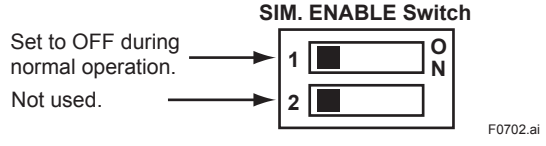


Figure 7.2 SIMULATE_ENABLE Switch Position

8. DEVICE STATUS

In a digitalYEWFLO, the current device statuses and error details are represented by parameters DEVICE_STATUS_1 to DEVICE_STATUS_5 (indexes 1045 to 1049) inside the resource statuses.

Table 8.1 Contents of DEVICE_STATUS_1 (Index 1045)

Hexadecimal	Display through DD	Description
0x04000000	Abnormal boot process	Abnormal boot processing was detected at the time of starting.
0x02000000	Download failure	Software download failed.
0x01000000	Download incomplete	Software download is incomplete.
0x00800000	Simulate enable jumper On	The SIMULATE_ENABLE switch is ON.
0x00400000	RB in O/S mode (AL-21)	The resource block is in O/S mode.
0x00080000	AMP. module failure 2 (AL-04)	The EEPROM (F) is faulty.
0x00008000	Link Obj.1/17/33 not open	The VCR selected in link object is not open.
0x00004000	Link Obj.2/18/34 not open	The VCR selected in link object is not open.
0x00002000	Link Obj.3/19/35 not open	The VCR selected in link object is not open.
0x00001000	Link Obj.4/20/36 not open	The VCR selected in link object is not open.
0x00000800	Link Obj.5/21/37 not open	The VCR selected in link object is not open.
0x00000400	Link Obj.6/22/38 not open	The VCR selected in link object is not open.
0x00000200	Link Obj.7/23/39 not open	The VCR selected in link object is not open.
0x00000100	Link Obj.8/24/40 not open	The VCR selected in link object is not open.
0x00000080	Link Obj.9/25 not open	The VCR selected in Link object is not open.
0x00000040	Link Obj.10/26 not open	The VCR selected in Link object is not open.
0x00000020	Link Obj.11/27 not open	The VCR selected in Link object is not open.
0x00000010	Link Obj.12/28 not open	The VCR selected in Link object is not open.
0x00000008	Link Obj.13/29 not open	The VCR selected in Link object is not open.
0x00000004	Link Obj.14/30 not open	The VCR selected in Link object is not open.
0x00000002	Link Obj.15/31 not open	The VCR selected in Link object is not open.
0x00000001	Link Obj.16/32 not open	The VCR selected in Link object is not open.

Table 8.2 Contents of DEVICE_STATUS_2 (Index 1046)

Hexadecimal	Display through DD	Description
0x00000040	Temp. sensor failure (AL-08)	The temperature sensor is faulty.
0x00000020	Temp. converter failure (AL-07)	The temperature circuit in the amplifier is faulty.
0x00000010	Input circuit failure (AL-06)	The input circuit is in the amplifier is faulty.
0x00000008	Flow sensor failure (AL-05)	The flow sensor is faulty.
0x00000004	COM. circuit failure 2 (AL-03)	The fieldbus communication circuit in the amplifier is faulty (type 2 error).
0x00000002	COM. circuit failure 1 (AL-02)	The fieldbus communication circuit in the amplifier is faulty (type 1 error).
0x00000001	AMP. module failure 1 (AL-01)	The EEPROM (S) is faulty.

Table 8.3 Contents of DEVICE_STATUS_3 (Index 1047)

Hexadecimal	Display through DD	Description
0x10000000	No FB scheduled (AL-20)	No function blocks are scheduled.
0x02000000	TB in O/S mode (AL-22)	The transducer block is in O/S mode.
0x01000000	AI1 in O/S mode (AL-23)	The AI1 block is in O/S mode.
0x00800000	AI2 in O/S mode (AL-24)	The AI2 block is in O/S mode.
0x00400000	DI1 in O/S mode (AL-25)	The DI1 block is in O/S mode.
0x00200000	DI2 in O/S mode (AL-26)	The DI2 block is in O/S mode.
0x00100000	PID in O/S mode (AL-27)	The PID block is in O/S mode.
0x00040000	AI1 in MAN mode (AL-62)	The AI1 block is in manual mode.
0x00020000	AI1 Simulation Active (AL-63)	Simulation is enabled in the AI1 block.
0x00010000	AI1 not Scheduled (AL-64)	The AI1 block is not scheduled.
0x00004000	AI2 in Man Mode (AL-65)	The AI2 block is in manual mode.
0x00002000	AI2 Simulate Active (AL-66)	Simulation is enabled in the AI2 block.
0x00001000	AI2 not scheduled (AL-67)	The AI2 block is not scheduled.
0x00000400	DI1 in MAN mode (AL-68)	The DI1 block is in manual mode.
0x00000200	DI1 in simulate active (AL-69)	Simulation is enabled in the DI1 block
0x00000100	DI1 not scheduled (AL-70)	The DI1 block is not scheduled.
0x00000040	DI2 in MAN mode (AL-71)	The DI2 block is in manual mode.
0x00000020	DI2 in simulate active (AL-72)	Simulation is enabled in the DI2 block.
0x00000010	DI2 not scheduled (AL-73)	The DI2 block is not scheduled.
0x00000004	PID in BYPASS mode (AL-74)	The PID block is in BYPASS mode.
0x00000002	PID error 1 (AL-75)	PID block error 1
0x00000001	PID error 2 (AL-76)	PID block error 2

Table 8.4 Contents of DEVICE_STATUS_4 (Index 1048)

Hexadecimal	Display through DD	Description
0x00000100	Indicator over range (AL-61)	Indicator overrange
0x00000080	Flow velocity over range (AL-41)	Flow velocity overrange
0x00000040	Flow rate span exceed limit (AL-42)	The flow rate span setting exceeds the range limit.
0x00000020	Temp. over range (AL-43)	Temperature overrange
0x00000008	Transient vibration (AL-51)	Transient excessive vibration (transient disturbance)
0x00000004	High vibration (AL-52)	Excessive vibration
0x00000002	Clogging (AL-53)	Flow anomaly (clogging)
0x00000001	Fluctuating (AL-54)	Flow anomaly (excessive output fluctuations)

Table 8.5 Contents of DEVICE_STATUS_5 (Index 1049)

Hexadecimal	Display through DD	Description
0x08000000	AI3 in O/S mode (AL-28)	AI3 Block is in O/S mode.
0x04000000	IT in O/S mode (AL-29)	IT Block is in O/S mode.
0x02000000	AR in O/S mode (AL-30)	AR Block is in O/S mode.
0x00800000	AI3 in MAN mode (AL-77)	AI3 Block is in Manual mode.
0x00400000	AI3 in simulate active (AL-78)	AI3 Block is in simulation mode.
0x00200000	AI3 not scheduled (AL-79)	AI3 Block is not scheduled.
0x00080000	IT in MAN mode (AL-80)	IT Block is in Manual mode.
0x00040000	IT not scheduled (AL-81)	IT Block is not scheduled.
0x00020000	IT Total not saved (AL-82)	IT Total backup failed. Last IT Output.Value(IT.OUT.Value) could not saved.
0x00010000	IT Conf. Err CLOCK_PER (AL-83)	IT Clock Period (IT.CLOCK_PER) is smaller than IT Period of Execution(IT. EXECUTION_PERIOD).
0x00004000	AR in MAN mode (AL-84)	AR Block is in Manual mode.
0x00002000	AR not scheduled (AL-85)	AR Block is not scheduled.
0x00001000	AR Conf. Err RANGE_HI/LO (AL-86)	AR Range High (AR.RANGE_HI) is smaller than AR Range Low (AR.RANGE_ LOW).
0x00000800	AR Temp. IN over range (AL-87)	AR Input1 (AR.IN_1) is over range.
0x00000400	AR Press IN over range (AL-88)	AR Input2 (AR.IN_2) is over range.
0x00000200	AR Flow IN not connect (AL-89)	AR Input (AR.IN) is not connected to the volumetric flow.
0x00000100	AR Temp. IN not connect (AL-90)	AR Input1 (AR.IN_1) is not connected to the temperature.
0x00000080	AR Press IN not connect (AL-91)	AR Input2 (AR.IN_2) is not connected to the pressure.
0x00000040	AR Conf. Err Comp. coef. (AL-92)	AR Compensation Coefficient (AR.AR_FLOW_CONFIG.Element) changed unexpected. Therefore AR Output (AR.OUT.Value) is uncertainty.
0x00000020	AR Conf. Err Output unit (AL-93)	AR Output Range .Units Index (AR.OUT_RANGE.Unit Index) is not selected rightly the corresponding to AR Arithmetic Type (AR.ARITH_TYPE).

9. GENERAL SPECIFICATIONS

9.1 Standard Specifications

For items other than those described below, refer to GS 01F06A00-01EN.

Applicable Models:

All the models of DY and DYA with Fieldbus communication functions (Output code: F). These models conform to the following EMC Conformity Standards:

EN 61326-1: 2006 Class A, Table 2 (For use in industrial locations), EN 61326-2-3: 2006

Caution: This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

Note: Use the metal conduit for the remote cable.

● Performance Specifications

Mass Flow Accuracy using Arithmetic (AR) function block:
(when outer temperature sensor and outer pressure sensor are used)

Accuracy ± %: of Reading

Fluid	Mass Flow Accuracy (Note 1, Note 2)	Notes		
		Input for Temperature, Pressure	Reference input condition for Mass Flow Accuracy	Flow computing
Saturated steam (Temperature base)	±1.7% (Flow velocity 35m/s or less) ±2.2% (Flow velocity 35m/s to 80m/s)	Temperature	Temperature range +100 to +330°C Temperature accuracy ±0.1%	Density computing by temperature using standard steam table (IAPWS-IF97: International Associaton for the Properties of Water and Steam)
Saturated steam (Pressure base)		Pressure	Pressure range 0.1MPa to flange rating Pressure accuracy ±0.2%	Density computing by pressure using standard steam table (IAPWS-IF97: International Associaton for the Properties of Water and Steam)
Superheated steam		Temperature and Pressure	Pressure condition: Pressure range 0.1MPa to flange rating Pressure accuracy ±0.2% Temperature condition: Temperature range +100 to + 450°C Temperature accuracy ±0.1%	Density computing by temperature and pressure using standard steam table (IAPWS-IF97: International Associaton for the Properties of Water and Steam)
General gas	Not fixed	Temperature and Pressure	Accuracy is changed by fluctuating deviation factor K on temperature, pressure condition	Temperature, pressure compensation computing using gas equation (Boyle-Charles's) at fixed deviation factor K.
Liquid	Not fixed	Temperature	Accuracy is changed by setting value for temperature compensation factor	Density computing by temperature using equation API • JIS K 2249.
General gas including Natural gas	±1.1% (Flow velocity 35m/s or less) ±1.6% (Flow velocity 35m/s to 80m/s)	Temperature and Pressure	For Natural gas accuracy condition is Pressure condition: Pressure range 0 to 12MPa Pressure signal ±0.2% Temperature condition: Temperature range –10 to + 65°C Temperature signal ±0.1% General gas is computed using physical properties supported by DIPPR database (AIChE: American Institute of Chemical Engineers)	For natural gas, AGA No.8 is applied for temperature, pressure compensation computing For general gas and liquid, DIPPR database is applied (AIChE: American Institute of Chemical Engineers) for Mass flow computing. Density calculation parameters are downloaded by FSA120 • FieldMate FlowNavigator (Note 3)
Liquid	Not fixed	Temperature	Computed using physical properties supported by DIPPR database (AIChE: American Institute of Chemical Engineers)	

Note 1) Mass Flow Accuracy for Steam and Natural gas is computed adding by Temperature and Pressure compensation based on Volumetric Flow Accuracy.
Note 2) Refer to GS 01F06A00-01EN about mass and volmetric flow accuracy of AI1 output.
Note 3) Refer to GS 01C25R51-01EN.

Mass Flow or Volumetric Flow at Norminal/Standard condition Accuracy using Arithmetic (AR) function block:
(when Multi-Variable Type (option code: /MV), High Process Temperature Version Multi-Variable Type (combination of option code /HT and /MV) and outer pressure sensor are used)
Accuracy ± %: of Reading

Fluid	Mass Flow Accuracy (Note 1, Note 2)	Notes		
		Input for Temperature, Pressure	Reference condition for Mass Flow Accuracy	Flow computing
Saturated steam (Temperature base)	±2.0% (Flow velocity 35m/s or less) ±2.5% (Flow velocity 35m/s to 80m/s)	Temperature	Temperature range +100 to +250°C (/MV) +100 to +330°C (/HT/MV)	Density computing by temperature using standard steam table (IAPWS-IF97: International Associaton for the Properties of Water and Steam)
Saturated steam (Pressure base)		Pressure	Pressure range 0.1MPa to flange rating Pressure accuracy ±0.2%	Density computing by pressure using standard steam table (IAPWS-IF97: International Associaton for the Properties of Water and Steam)
Superheated steam		Temperature and Pressure	Pressure condition: Pressure range 0.1MPa to flange rating Pressure accuracy ±0.2% Temperature condition: Temperature range +100 to +250°C (/MV) +100 to +400°C (/HT/MV)	Density computing by temperature and pressure using standard steam table (IAPWS-IF97: International Associaton for the Properties of Water and Steam)
General gas	Not fixed	Temperature and Pressure	Accuracy is changed by fluctuating deviation factor K on temperature, pressure condition	Temperature, pressure compensation computing using gas equation (Boyle-Charles's) at fixed deviation factor K.
Liquid	Not fixed	Temperature	Accuracy is changed by setting value for temperature compensation factor	Density computing by temperature using equation API • JIS K 2249.
General gas including Natural gas	±2.0% (Flow velocity 35m/s or less) ±2.5% (Flow velocity 35m/s to 80m/s)	Temperature and Pressure	For Natural gas accuracy condition is Pressure condition: Pressure range 0 to 12MPa Pressure signal ±0.2% Temperature condition: Temperature range –10 to + 65°C General gas is computed using physical properties supported by DIPPR database (AIChE: American Institute of Chemical Engineers)	For natural gas, AGA No.8 is applied for temperature, pressure compensation computing For general gas and liquid, DIPPR database is applied (AIChE: American Institute of Chemical Engineers) for Mass flow computing. Density calculation parameters are downloaded by FSA120 • FieldMate FlowNavigator (Note 3)
Liquid	Not fixed	Temperature	Computed using physical properties supported by DIPPR database (AIChE: American Institute of Chemical Engineers)	

Note 1) Mass Flow Accuracy for Steam and Natural gas is computed adding by Temperature and Pressure compensation based on Volumetric Flow Accuracy.
Note 2) Refer to GS 01F06A00-01EN about mass and volumetric flow accuracy of AI1 output and temperature accuracy of AI2 output.
Note 3) Refer to GS 01C25R51-01EN.

● Electrical Specifications

Power Supply Voltage:
9 to 32 V DC for general-purpose, flameproof types and Nonincendive type
9 to 24 V DC for intrinsically safe type (Entity model)
9 to 17.5 V DC for intrinsically safe type (FISCO model)

Output Signals:
Digital communication signal compliant with the FOUNDATION Fieldbus protocol

Condition of Communication Line:
Supply voltage: 9 to 32 V DC
Supply current: 15 mA maximum
24 mA maximum for the software download

Functional Specifications:

Functional specifications for Fieldbus communication conform to the standard specifications (H1) of FOUNDATION fieldbus.

FOUNDATION Fieldbus specifications (ITK 5.0.1) grant the interoperability of the field instruments.

Function blocks:

Block name	Number	Execution time	Note
AI	3	29 ms	AI1: Monitors the fow rate and totalized flow rate; AI2: Monitors the temperature for a model with the multi-variable type option; AI3: volumetric flow input for mass flowrate calculation of AR.
DI	2	25 ms	Flow and temperature limit switches
AR	1	40 ms	Mass flow calculation
IT	1	40 ms	Integrator block integrates a variable as a function of the time or accumulates the counts
PID	1	40 ms	Applicable when LC1 option is specified

9.2 Model and Suffix Codes

DY□□□-$^{F}_{N}$ □□□□□-□□/□

DYA-F□□/□

F: digital communication (FOUNDATION Fieldbus protocol)

N: Remote type detector

9.3 Optional Specifications

IMPORTANT

In case of the remote type, select the same specification (code) for both detector and converter.

For options other than below, refer to GS 01F06A00-01EN.

(Note1) For intrinsically safe approval, use the barrier certified by the testing laboratories (BARD-400 is not applicable).

Item	Description	Code
Multi-variable Type	Provides a temperature sensor (Pt 1000) built-in the vortex shedder bar, enabling the AI2 function block to output the process fluid temperature, and mass flow rates to be calculated. (For details, refer to GS 01F06A00-01EN.)	MV
PID Function	Provides a PID control function block.	LC1
Software download function	Based on FOUNDATION Fieldbus Specification (FF-883) Download class: Class 1	EE

Item	Description	Code
Factory Mutual (FM)	FM explosion-proof Approval Applicable Standard: FM3600, FM3611, FM3615, FM3810, Including Supplement 1 ANSI/NEMA 250 Type of Protection: Explosionproof for Class I, Division 1, Groups A, B, C, and D; Dust-ignitionproof Class II/III, Division 1, Groups E, F, and G. “SEAL ALL CONDUITS WITHIN 18 INCHES.” “WHEN INSTALLED IN DIV.2, SEALS NOT REQUIRED.” Enclosure Rating: Type 4X Temperature Code: T6 Ambient Temperature: –29 to +60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) –40 to +60°C (Remote Type Vortex Flow Converter) Ambient Humidity: 0 to 100%RH (No condensation) Coating of Enclosure: Epoxy resin coating or Polyurethane resin coating. Electrical Connection: ANSI 1/2NPT female	FF1
	FM Intrinsically Safe Approval (Note 1) , Nonincendive Applicable Standard: FM3600, FM3610, FM3611, FM3810, NEMA-250, ANSI/ISA-60079-0, ANSI/ISA-60079-11, ISA60079-27 Type of Protection : Intrinsically Safe for Class I, II, III, DIV.1, Groups A, B, C, D, E, F and G, T4, and Class I, Zone 0, AEx ia IIB/IIC T4, Entity, FISCO Nonincendive for Class I, II, Div.2, Groups A, B, C, D, F and G, Class III, DIV.1, Class I, Zone 2, Group IIC, FNICO Ambient Temperature : –29 to +60°C (Integral Type Vortex Flowmeter) –29 to +80°C (Remote Type Vortex Flow Detector) –40 to +60°C (Remote Type Vortex Flow Converter) Ambient Humidity : 0 to 100%RH (No condensation) Indoors and Outdoors : Type 4X Electrical Parameters : Intrinsically Safe [Entity] Vmax=24V, Imax=250mA, Pi=1.2W, Ci=3.52nF, Li=0 [FISCO (IIC)] Vmax=17.5V, Imax=380mA, Pi=5.32W, Ci=3.52nF, Li=0 [FISCO (IIB)] Vmax=17.5V, Imax=460mA, Pi=5.32W, Ci=3.52nF, Li=0 Nonincendive Vmax=32V, Ci=3.52nF, Li=0 Electrical Connection : ANSI 1/2NPT female	FS16
ATEX	ATEX Flameproof Approval Applicable Standard: EN 60079-0, EN 60079-1 Type of Protection: II 2 G Ex d IIC T6...T1 Gb (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) II 2 G Ex d IIC T6 Gb (Remote Type Vortex Flow Converter) Group : II, Category : 2 G Temperature Class : T6...T1 (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) T6 (Remote Type Vortex Flow Converter) Process Temperature : T6 (–29 to 80°C), T5 (–29 to 100°C), T4 (–29 to 135°C), T3 (–29 to 200°C), T2 (–29 to 300°C), T1 (–29 to 450°C) (Use /HT version above 250°C) Ambient Temperature: –29 to 60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) –40 to 60°C (Remote Type Vortex Flow Converter without indicator) –30 to 60°C (Remote Type Vortex Flow Converter with indicator) Ambient Humidity: 0 to 100%RH (No condensation) Electrical Connection: ANSI 1/2NPT female, ISO M20 × 1.5 female	KF2
	ATEX Intrinsically Safe Approval (Note 1) Applicable Standard : EN 50014, EN 50020, EN 60079-27, EN 50284 Type of Protection: EEx ia IIB/IIC T4...T1 (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) EEx ia IIB/IIC T4 (Remote Type Vortex Flow Converter) Groups: II Category: 1 G Ambient Temperature (Integral Type Vortex Flowmeter): –29 to +60°C Ambient Temperature (Remote Type Vortex Flow Detector): –29 to +80°C Ambient Temperature (Remote Type Vortex Flow Converter): –40 to +60°C Ambient Humidity: 0 to 100%RH (No condensation) Process Temperature : T4; 135°C, T3; 200°C, T2; 300°C, T1;450°C (Use /HT version above 250°C) For connection to certified Intrinsically Safe circuit with Supply circuit of Integral Type Flowmeter and Remote Type Converter: [Entity] Vmax=24V, Imax=250mA, Pi=1.2W, Ci=1.76nF, Li=0 [FISCO (IIC)] Vmax=17.5V, Imax=380mA, Pi=5.32W, Ci=1.76nF [FISCO (IIB)] Vmax=17.5V, Imax=460mA, Pi=5.32W, Ci=1.76nF, Li=0 Connect sensor circuit of DYA and DY-N (/HT) Electrical Connection: ANSI 1/2NPT female, ISO M20 × 1.5 female	KS26

Item	Description	Code
Canadian Standards Association (CSA)	CSA explosion-proof Approval Applicable Standard: C22.1-98, C22.2 No.0, C22.2 No.0.4, C22.2 No.0.5, C22.2 No.25, C22.2 No.30, C22.2 No.94, C22.2 No.142, C22.2, No.61010-1, ANSI/ISA-12.27.01 Type of Protection: explosion-proof for Class I, Groups B, C and D; Class II, Groups E, F and G; Class III. For Class I, Division 2 locations- "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED." Enclosure: Type 4X Temperature Class: T6...T1 (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) T6 (Remote Type Vortex Flow Converter) Ambient Temperature: –29 to +60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) –40 to +60°C (Remote Type Vortex Flow Converter) Process Temperature : T6;85°C, T5;100°C, T4;135°C, T3;200°C, T2;300°C, T1;450°C Enclosure : Type 4X Coating of Enclosure: Epoxy resin coating or Polyurethane resin coating. Electrical Connection: ANSI 1/2NPT female (Special)	CF1
	Process Sealing Certification Dual Seal Certified by CSA to the requirement of ANSI/ISA 12.27.01 No additional sealing required	CF11
IECEx	IECEx Flameproof Approval Applicable Standard: IEC60079-0, IEC60079-1 Type of Protection: Ex d IIC T6...T1 Gb (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) Ex d IIC T6 Gb (Remote Type Vortex Flow Converter) Temperature Class : T6...T1 (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) T6 (Remote Type Vortex Flow Converter) Process Temperature : T6 (–40 to 80°C), T5 (–40 to 100°C), T4 (–40 to 135°C), T3 (–40 to 200°C), T2 (–40 to 300°C), T1 (–40 to 450°C) (Use /HT version above 250°C) Ambient Temperature: –29 to 60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) –40 to 60°C (Remote Type Vortex Flow Converter without indicator) –30 to 60°C (Remote Type Vortex Flow Converter with indicator) Ambient Humidity: 0 to 100%RH (No condensation) Electrical Connection: ANSI 1/2NPT female, ISO M20 × 1.5 female	SF2
Technology Institution of Industrial Safety (TIIS), Japan	TIIS explosion-proof Ex d IIC T6 approval Ambient Temperature: –20 to 60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector) Electrical connection: JIS G1/2 female	JF3

<Factory setting>

Item	AI1 for Flow Rate Signal (Standard)	AI2 for Temperature Signal (with MV Option)
Tag number (PD_TAG)	Set to "FT1003" by default unless otherwise specified when ordered.	
Output mode (L_TYPE)	"Direct"	
Upper and lower calculation range limits and unit (XD_SCALE)	The upper range limit will be set to the maximum flow rate range specified in the registered sizing data, or to the 0 to 10 m^3/h range in case of UNCALIBRATION.	–40 to +260°C or –40 to +482°F
Upper and lower output range limits and unit (OUT_SCALE) _		
Node address	Set to 0xF2 unless otherwise specified when ordered.	

Explanation of parameters:

(1) XD_SCALE: Defines the input values from the transducer block (input range of the sensor) corresponding to 0% and 100% values in the calculation inside the AI function block. For a digitalYEWFLO, the values set as the flow span or temperature range (option) are stored in this parameter.

(2) OUT_SCALE: Output scaling parameter. Defines the output values corresponding to 0% and 100% values in the calculation inside the AI function block.

(3) L_TYPE: Determines whether the values passed from the transducer block (sensor) should be output without processing ("Direct") or through scaling conversion based on OUT_SCALE ("Indirect").

10. EXPLOSION PROTECTED TYPE INSTRUMENT

In this section, further requirements and differences for explosion proof type instrument are described except JIS Flame proof. For explosion proof type instrument, the description in this chapter is prior to other description in this Instruction Manual.

WARNING

- Only trained persons use this instrument in industrial locations.

10.1 ATEX

WARNING

- Only trained persons use this instrument in industrial locations.
- Electrostatic charge may cause an explosion hazard.
  Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.

■ Technical Data

• Flameproof

Applicable Standard : EN 60079-0: 2009,
EN 60079-1: 2007
Certificate : DEKRA 11ATEX0212X
Type of Protection:
Group: II
Category: 2 G
Ex d IIC T6…T1 Gb (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
Ex d IIC T6 Gb (Remote Type Vortex Flow Convertor)
Specification of Protection:
Process Temperature: (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)

Temperature Class	Process Temperature
T6	-29°C to +80°C
T5	-29°C to +100°C
T4	-29°C to +135°C
T3	-29°C to +200°C
T2	-29°C to +300°C
T1	-29°C to +450°C

*1 Note: Use /HT version above 250°C

Temperature Class: T6 (Remote Type Vortex Flow Convertor)
Ambient Temp.:
–29 to +60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
–40 to +60°C (Remote Type Vortex Flow Convertor without indicator)
–30 to +60°C (Remote Type Vortex Flow Convertor with indicator)
Power Supply: 9 to 32Vdc max.
Special Fastener: Class A2-50 or more

• Intrinsically Safe

Applicable Standard: EN 50014: 1997 +A1, +A2,
EN 50020: 2002,
EN 60079-27: 2006,
EN 50284: 1999
Certificate: KEMA 03ATEX1136X
Type of Protection: EEx ia IIB/IIC T4...T1 (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
EEx ia IIB/IIC T4 (Remote Type Vortex Flow Converter)
Group: II
Category: 1 G
Tamb: –29 to +60°C (Integral Type Vortex Flowmeter)
–29 to +80°C (Remote Type Vortex Flow Detector)
–40 to +60°C (Remote Type Vortex Flow Converter)

(Integral Type Vortex Flowmeter)

Temperature Class	Ambient Temperature	Process Temperature
T4	60°C	≤135°C
T3	60°C	≤200°C
T2*	60°C	≤300°C
T1*	60°C	≤450°C

*: Use /HT version above 250°C

(Remote Type Vortex Flow Detector)

Temperature Class	Ambient Temperature	Process Temperature
T4	80°C	≤135°C
T3	80°C	≤200°C
T2*	80°C	≤300°C
T1*	80°C	≤450°C

*: Use /HT version above 250°C

Electrical data:
Supply and Output Circuit (SUPPLY + and -, PULSE + and -);
Maximum Input Voltage Ui = 30 V
Maximum Input Current Ii = 165 mA
Maximum Input Power Pi = 0.9 W
Internal Capacitance Ci = 1.76nF
Internal Inductance Li = 0mH

For the connection of DYA to DY-N :
Maximum cable capacitance: 160nF
Electrical Connection: ANSI 1/2 NPT female, ISO M20 X 1.5 female

Special conditions for safe use

1. For process temperatures above 250°C the flow meters of the /HT version must be used.
2. Because the enclosures of the flow meters and the flow converter are made of aluminium alloy, when used in an potentially explosive atmosphere requiring apparatus of equipment categoly 1 G, they must be installed so, that even in the event of rare incidents, an ignition source due to impact of friction between the enclosure and iron/steel is excluded.

■ Installation

WARNING

- All wiring shall comply with local installation requirements and local electrical code.
- Use the suitable heat-resisting cables (over 90°C) for the digitalYEWFLO Model DY Series Vortex Flowmeter when the ambient temperature exceeds 60°C and/or the process temperature exceeds 200°C.
- Cable glands, adapters and/or blanking elements shall be of Ex “d” for Ex “d” installations. They shall be installed so as to maintain the specified degree of protection (IP Code) of the flowmeter.
- Unused apertures shall be closed with above-mentioned blanking elements (in case of Ex “d” installations).

The grounding terminals are located on the inside and outside of the terminal area.
Connect the cable to grounding terminal in accordance with wiring procedure (1) or (2).

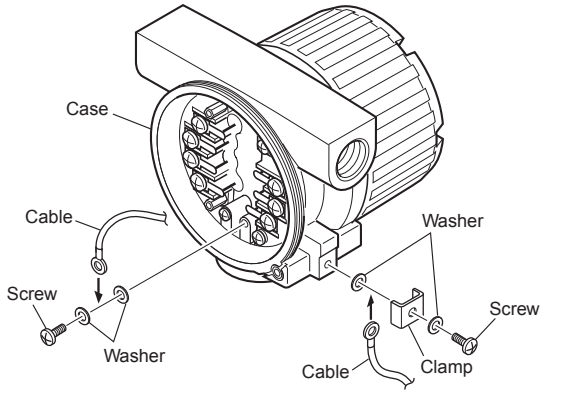


Figure 10.1 Wiring Procedure for Grounding Terminals for Flameproof

■ Operation

WARNING

- Wait 3 min. after power is turned off, before opening the covers.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

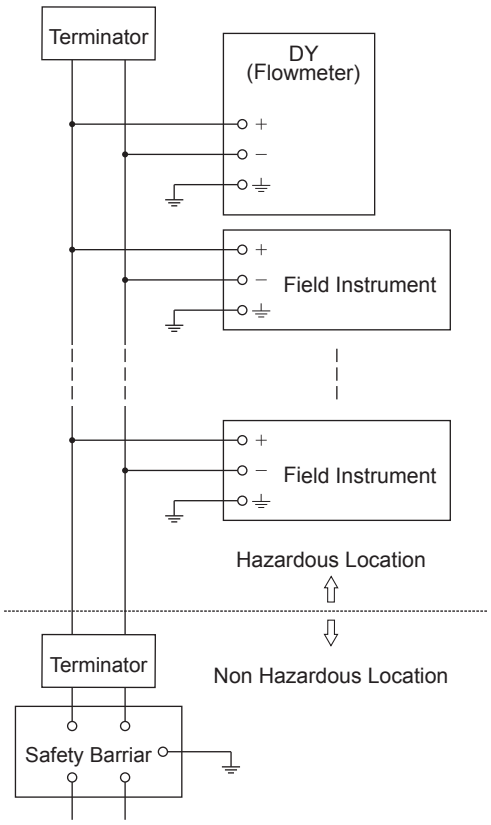
■ Maintenance and Repair

WARNING

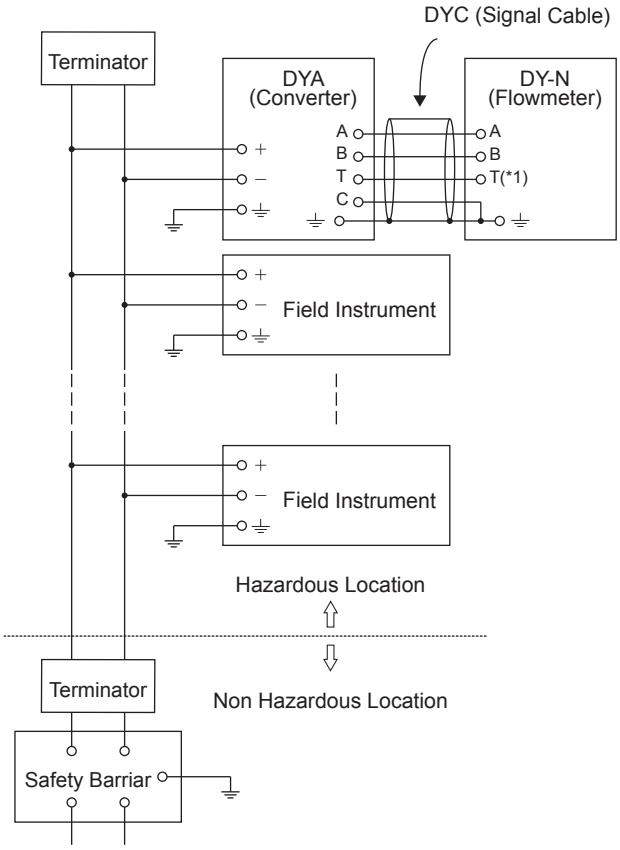
- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the certification.

■ Installation Diagram of Intrinsically safe (and Note)

[Integral type]



[Remote type]



(*1): Wire for T termanal
With temperature sensor type: Installed
Without temperature sensor type: Not Installed

Note
- In the rating 1, the output current of the barrier must be limited by a resistor 'Ra' such that Io=Uo/Ra.
- In the rating 2, the output of the barrier must be the characteristics of the trapezoid or the rectangle and this transmitter can be connected to Fieldbus equipment which are in according to the FISCO model.
- The terminators may be built-in by a barrier.
- More than one field instrument may be connected to the power supply line.
- The terminator and the safety barrier shall be certified.

F1002.ai

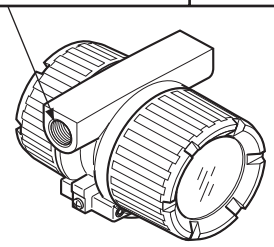
Electrical data

	II C		II B
	Rating1 (Entity)	**Rating2 (FISCO)**	**Rating3 (FISCO)**
Maximum Input Voltage Ui	24V	17.5V	17.5V
Maximum Input Current Ii	250mA	380mA	460mA
Maximum Input Power Pi	1.2W	5.32W	5.32W
Maximum Internal Capacitance Ci	1.76nF	1.76nF	1.76nF
Maximum Internal Inductance Li	0	0	0

■ Screw Marking

The type of electrical connection is stamped near the electrical connection port according to the following codes.

Screw size	Marking
ISO M20 X 1.5 female	⚠ M
ANSI 1/2-14NPT female	⚠ N or ⚠ A



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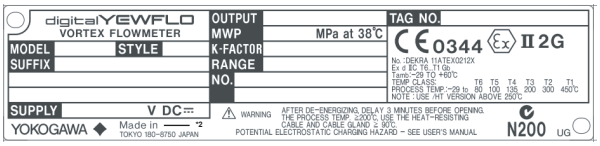
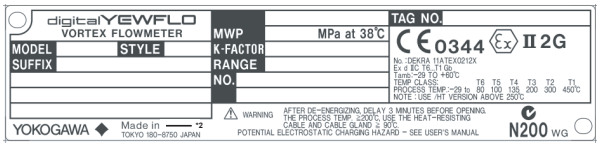
■ Name Plate

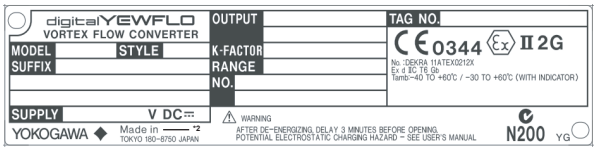
[Integral type, Flameproof]



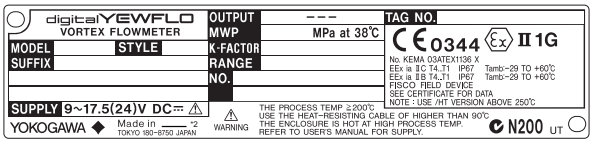
[Remote type detector, Flameproof]



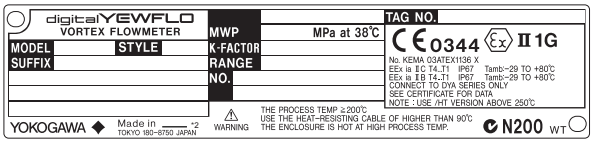
[Remote type converter, Flameproof]



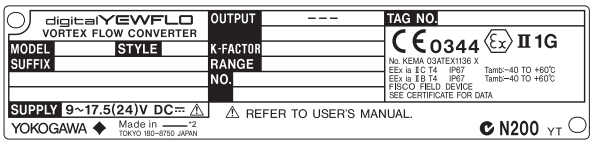
[Integral type, Intrinsically safe]



[Remote type detector, Intrinsically safe]



[Remote type converter, Intrinsically safe]



MODEL: Specified model code
SUFFIX : Specified suffix code
STYLE: Style code
SUPPLY : Supply voltage
OUTPUT : Output signal
MWP : Maximum working pressure
K-FACTOR : Device-specific factor
RANGE: Specified range
NO.: Upper column: Manufacturing serial number *1
Lower column: The year of production
TAG NO. : Specified TAG No.
CE: CE marking
0344: The indentification number of the notified body
II1G: Group II Category 1 Gas atmosphere
II2G: Group II Category 2 Gas atmosphere
II3G: Group II Category 3 Gas atmosphere

*1) The first digit in the final three numbers of the serial number appearing after “NO.” on the name plate indicates the year of production. The following is an example of a serial number for a product that was produced in 2013:
NO. S5K965926 3335
↑Produced in 2013

*2) The product-producing country

10.2 FM

■ Technical Data

• Explosion Proof

Applicable Standard: FM3600 2011, FM3611 2004, FM3615 2006, FM3810 1989, Including Supplement 1 1995, ANSI/NEMA 250 1991

Type of Protection: Explosion proof for Class I, Division 1, Groups A,B, C and D; Dust-ignition proof for Class II/III, Division 1, Groups E, F,and G.

"SEAL ALL CONDUITS 18 INCHES." " WHEN INSTALLED IN DIV.2, SEALS NOT REQUIRED"

Enclosure Rating: Type 4X

Temperature Code: T6

Ambient Temperature: -29 to 60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
-40 to 60°C (Remote Type Vortex Flow Converter)

Power Supply: 9 to 32Vdc (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Converter)

Output Signal (Remote Type Vortex Flow Detector): Output Signal to Converter; 30Vp-p, 100μAp-p

Input/Output Signal (Remote Type Vortex Flow Converter):
Input Signal from Flowmeter; 30Vp-p, 100μAp-p

Electrical connection : ANSI 1/2 NPT female (Special)

• Intrinsically Safe

Applicable Standard: FM3600: 1998, FM3610: 2010, FM3611: 2004, FM3810: 2005, NEMA 250: 1991, ANSI/ISA-60079-0: 2009, ANSI/ISA-60079-11: 2009, ISA 60079-27: 2006

Type of Protection : Intrinsically Safe for Class I, II, III, DIV.1, Groups A, B, C, D, E, F and G, T4, and Class I, Zone 0, AEx ia IIB/IIC T4, Entity, FISCO
Nonincendive for Class I, II, Div.2, Groups A, B, C, D, F and G, Class III, DIV.1, Class I, Zone 2, Group IIC, FNICO

Ambient Temperature :
–29 to +60°C (Integral Type Vortex Flowmeter)
–29 to +80°C (Remote Type Vortex Flow Detector)
–40 to +60°C (Remote Type Vortex Flow Converter)

Indoors and Outdoors : Type 4X

Electrical Parameters : Intrinsically Safe
[Entity] Vmax=24V, Imax=250mA, Pi=1.2W, Ci=3.52nF, Li=0
[FISCO (IIC)] Vmax=17.5V, Imax=380mA, Pi=5.32W, Ci=3.52nF
[FISCO (IIB)] Vmax=17.5V, Imax=460mA, Pi=5.32W, Ci=3.52nF, Li=0
Nonincendive
Vmax=32V, Ci=3.52nF, Li=0

■ Wiring

• Explosion proof

WARNING

- All wiring shall comply with National Electrical Code ANSI/NFPA 70 and Local Electrical Code.
- "SEAL ALL CONDUITS 18 INCHES" " WHEN INSTALLED DIV.2, SEALS NOT REQUIRED".

• Intrinsically Safe

NOTE

- The FM Approved Hand Held Communicator may be connected at any point in the loop between the digitalYEWFLO and the Control Equipment.

■ Operation

• Explosion proof

WARNING

- Note a warning label worded as follows.
  Warning: OPEN CIRCUIT BEFORE
  REMOVING COVER.
  INSTALL IN ACCORDANCE WITH
  THE INSTRUCTION MANUAL (IM)
  IF6A1-01E.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

■ Maintenance and Repair

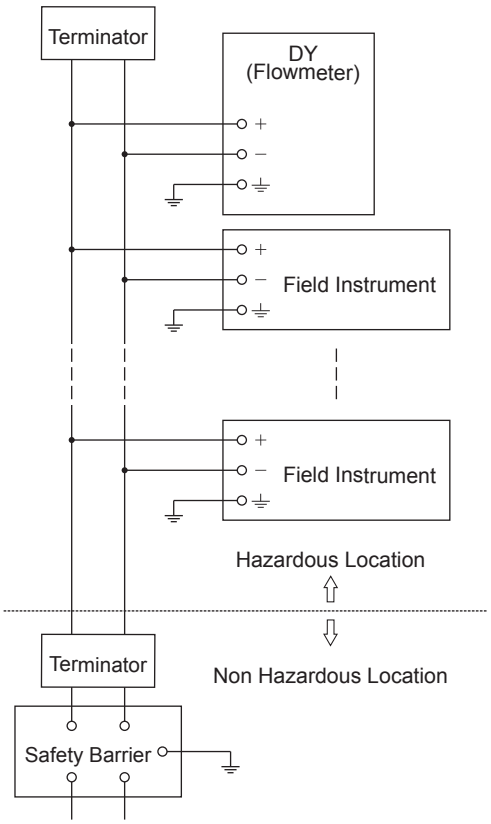
WARNING

- The instrument modification or part replacements by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the approval of FM Approvals.

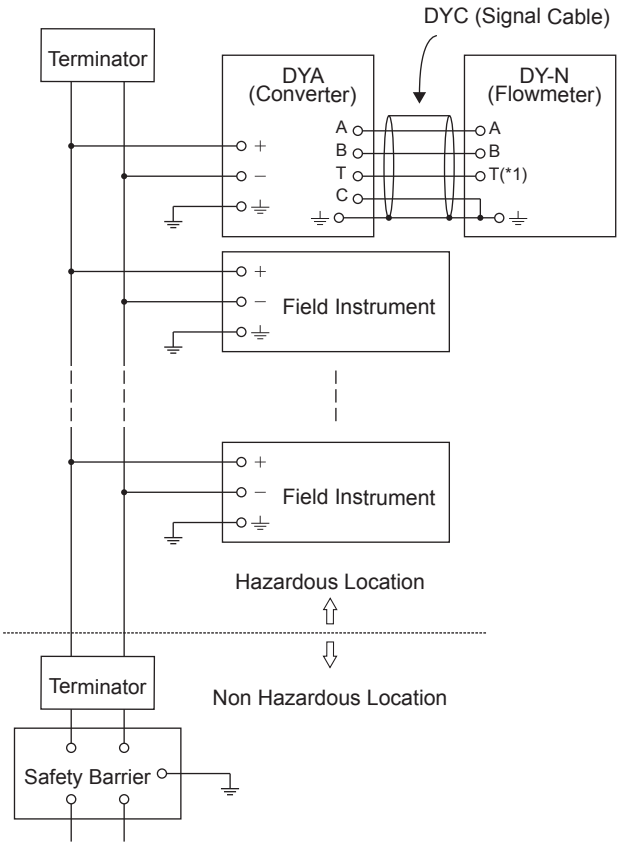
■ Installation Diagram

Intrinsically Safe (and WARNING)

[Integral type]



[Remote type]



(*1) Wire for T terminal
With Temperature sensor type : installed
Without Temperature sensor type : not installed

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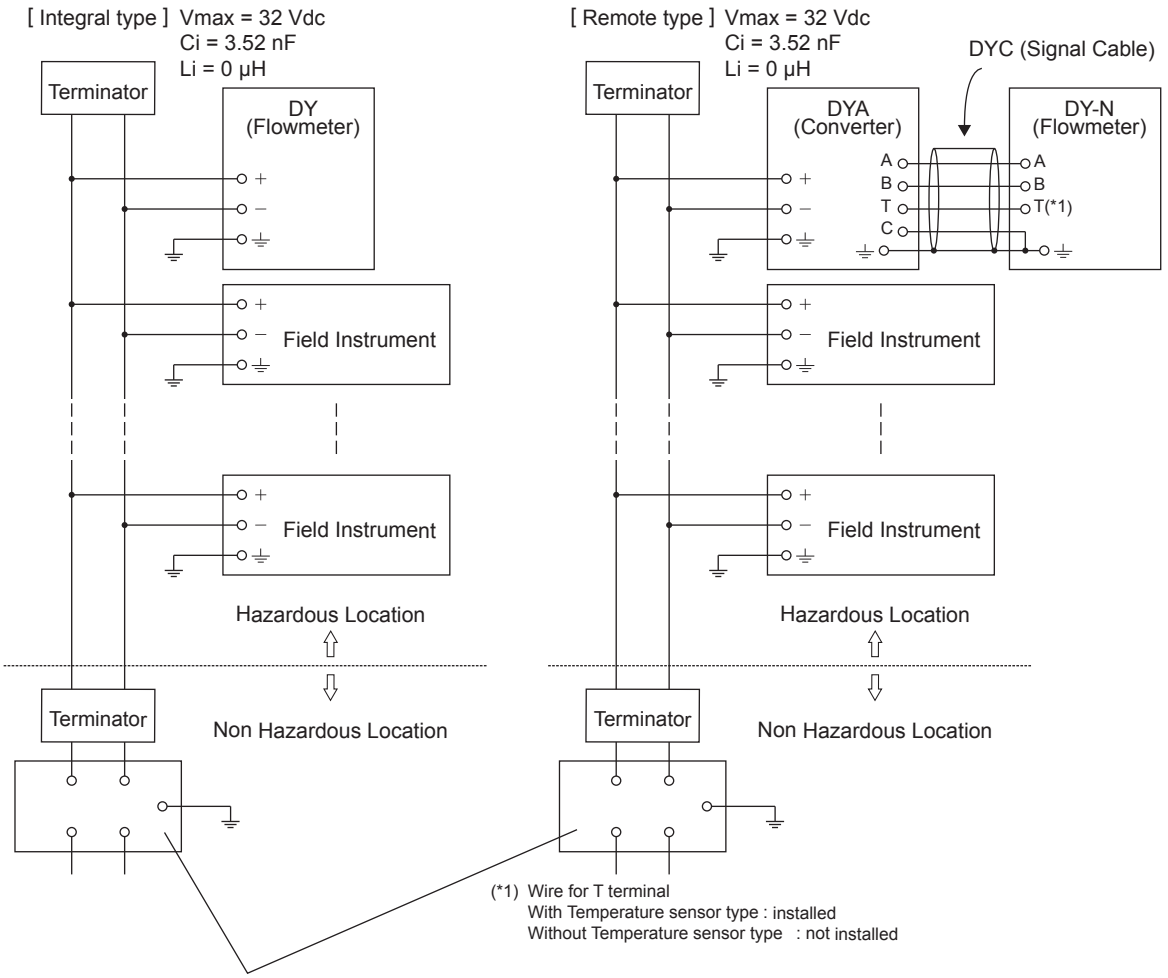
- **FISCO rules**

The FISCO Concept allows the interconnection of intrinsically safe apparatus to Safety Barrier not specifically examined in such combination. The criterion for such interconnection is that the voltage (Vmax), the current (Imax) and the power (Pi) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo, Voc, Vt), the current (1o, Isc, It,) and the power (Po) which can be provided by the Safety Barrier (supply unit). In addition, the maximum unprotected residual capacitance (Ci) and inductance (Li) of each apparatus (other than the terminators) connected to the Fieldbus must be less than or equal to 5nF and 10 µH respectively.
In each I.S. Fieldbus segment only one active source, normally the Safety Barrier, is allowed to provide the necessary power for the Fieldbus system. The allowed voltage (Uo, Voc, Vt) of the Safety Barrier used to supply the bus must be limited to the range of 14V d.c. to 24V d.c. All other equipment connected to the bus cable has to be passive, meaning that the apparatus is not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to insure that the intrinsically safe Fieldbus circuit remains passive.
The cable used to interconnect the devices needs to comply with the following parameters:
Loop resistance R': 15 ... 150 Ω/KM
Inductance per unit length L': 0.4 ... 1mH/km
Capacitance per unit length C': 80 ... 200 nF/km
C' = C' line/line + 0.5 C' line/screen, if both lines are floating
or
C'= C' line/line + C' line/screen, if the screen is connected to one line
Length of spur Cable: max. 30m
Length of trunk cable: max. 1Km
Length of splice: max. 1m
Terminators
At each end of the trunk cable an approved line terminator with the following parameters is suitable:
R = 90 ... 100Ω
C = 0 ... 2.2 µF.
System evaluation
The number of passive devices like transmitters, actuators, connected to a single bus segment is not limited due to I.S. reasons. Furthermore, if the above rules are respected, the inductance and capacitance of the cable need not to be considered and will not impair the intrinsic safety of the installation.

Installation Notes For FISCO and Entity Concepts:

1. The Intrinsic Safety Entity concept allows the interconnection of FM Approved Intrinsically safe devices with entity parameters not specifically examined in combination as a system when:
   Uo or Voc or Vt ≤ Vmax, Io or Isc or It ≤ Imax, Po ≤ Pi. Ca or Co ≥ ∑Ci + ∑Ccable, For inductance use either La or Lo ≥ ∑Li + ∑Lcable or Lc/Rc ≤ (La/Ra or Lo/Ro) and Li/Ri ≤ (La/Ra or Lo/Ro)
2. The Intrinsic Safety FISCO concept allows the interconnection of FM Approved Intrinsically safe devices with FISCO parameters not specifically examined in combination as a system when:
   Uo or Voc or Vt ≤ Vmax, Io or Isc or It ≤ Imax, Po ≤ Pi.
3. The Safety Barrier shall be a linear supply for Entity installations and either a linear supply or a trapezoidal supply for FISCO Installations.
4. Dust-tight conduit seals must be used when installed in Class II and Class III environments.
5. Control equipment connected to the Safety Barrier must not use or generate more than 250 Vrms or Vdc.
6. Installation should be in accordance with ANSI/ISA RP12.06.01 (except chapter 5 for FISCO Installations) "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code® (ANSI/NFPA 70) Sections 504 and 505.
7. The configuration of Safety Barrier must be FM Approved under the associated concept.
8. Safety Barrier manufacturer's installation drawing must be followed when installing this equipment.
9. The (Product Name) Series are Approved for Class I, Zone 0, applications. If connecting AEx[ib] Safety Barrier or AEx ib I.S. Apparatus to the (Product Name) Series the I.S. circuit is only suitable for Class I, Zone 1, or Class I, Zone 2, and is not suitable for Class I, Zone 0 or Class I, Division 1, Hazardous (Classified) Locations."
10. No revision to drawing without prior FM Approval.


[Integral type] Vmax = 32 Vdc
Ci = 3.52 nF
Li = 0 µH
Terminator
DY
(Flowmeter)
Field Instrument
Field Instrument
Hazardous Location
Non Hazardous Location
Terminator
[Remote type] Vmax = 32 Vdc
Ci = 3.52 nF
Li = 0 µH
DYC (Signal Cable)
Terminator
DYA
(Converter)
DY-N
(Flowmeter)
A
B
T
C
A
B
T(*1)
Field Instrument
Field Instrument
Hazardous Location
Non Hazardous Location
Terminator
(*1) Wire for T terminal
With Temperature sensor type : installed
Without Temperature sensor type : not installed
(Nonincendive)
Power Supply
FM Approved Associated Nonincendive Field Wiring Apparatus
Vt or Voc
It or Isv
Ca
La

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NOTE

1. Dust-tight conduit seal must be used when installed in Class II and Class III environments.
2. Installation should be in accordance with the National Electrical Code® (ANSI/NFPA 70) Sections 504 and 505.
3. The configuration of Associated Nonincendive Field Wiring Apparatus must be FM Approved.
4. Associated Nonincendive Field Wiring Apparatus manufacturer's installation drawing must be followed when installing this equipment.
5. No revision to drawing without prior FM Approvals.
6. Terminator and supply unit must be FM Approved.
7. If use ordinary wirings, the general purpose equipment must have nonincendive field wiring terminal approved by FM Approvals.
8. The nonincendive field wiring circuit concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for unclassified locations.
9. Installation requirements;
   Vmax ≥ Voc or Vt
   Imax = see note 10.
   Ca ≥ Ci + Ccable
   La ≥ Li + Lcable
10. For this current controlled circuit, the parameter (Imax) is not required and need not be aligned with parameter (Isc or It) of the barrier or associated nonincendive field wiring apparatus.
11. Approved under FNICO Concept.

Electrical data:
   Vmax = 32V
   Ci = 3.52nF
   Li = 0

10.3 IECEx

WARNING

- Only trained persons use this instrument in industrial locations.
- Electrostatic charge may cause an explosion hazard.
  Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.

■ Technical Data

• Flameproof

Applicable Standard : IEC60079-0: 2007-10,
IEC60079-1: 2007-04
Certificate : IECEx DEK 11.0077X
Type of Protection:
Ex d IIC T6…T1 Gb (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
Ex d IIC T6 Gb (Remote Type Vortex Flow Convertor)
Specification of Protection:
Process Temperature: (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)

Temperature Class	Process Temperature
T6	-29°C to +80°C
T5	-29°C to +100°C
T4	-29°C to +135°C
T3	-29°C to +200°C
T2	-29°C to +300°C
T1	-29°C to +450°C

*1 Note: Use /HT version above 250°C

Temperature Class: T6 (Remote Type Vortex Flow Convertor)
Ambient Temp.:
–29 to +60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
–40 to +60°C (Remote Type Vortex Flow Convertor without indicator)
–30 to +60°C (Remote Type Vortex Flow Convertor with indicator)
Power Supply: 9 to 32Vdc max.
Special Fastener: Class A2-50 or more

Special conditions for safe use

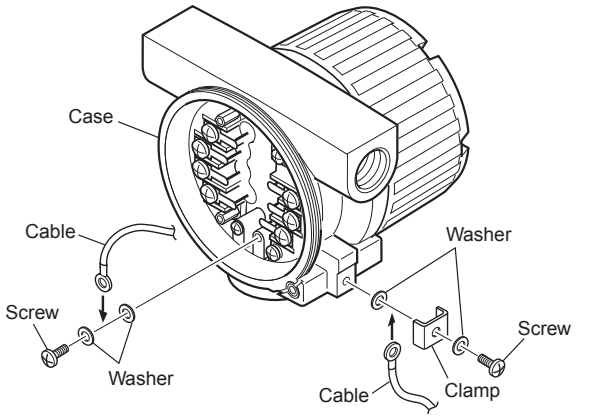
1. For process temperatures above 250°C the flow meters of the /HT version must be used.

■ Installation

WARNING

- All wiring shall comply with local installation requirements and local electrical code.
- Use the suitable heat-resisting cables (over 90°C) for the digitalYEWFLO Model DY Series Vortex Flowmeter when the ambient temperature exceeds 60°C and/or the process temperature exceeds 200°C.
- The cable entry devices shall be certified in type of protection flame proof enclosure “d” and suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with certified blanking elements in type of protection flame proof enclose “d”.

The grounding terminals are located on the inside and outside of the terminal area.
Connect the cable to grounding terminal in accordance with wiring procedure (1) or (2).



(1) Internal grounding terminal (2) External grounding terminal

Figure 10.2 Wiring Procedure for Grounding Terminals

■ Operation

WARNING

- Wait 3 min. after power is turned off, before opening the covers.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

■ Maintenance and Repair

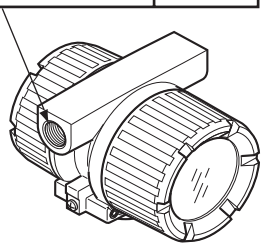
WARNING

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the certification.

■ Electrical Connection

The type of electrical connection is stamped near the electrical connection port according to the following codes.

Screw size	Marking
ISO M20 X 1.5 female	⚠ M
ANSI 1/2-14NPT female	⚠ N



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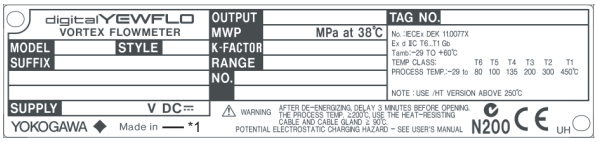
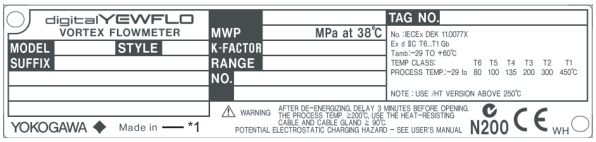
■ Name Plate

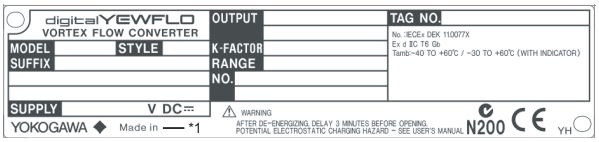
[Integral type, Flameproof]



[Remote type detector, Flameproof]



[Remote type converter, Flameproof]



MODEL: Specified model code
SUFFIX : Specified suffix code
STYLE: Style code
SUPPLY : Supply voltage
OUTPUT : Output signal
MWP : Maximum working pressure
K-FACTOR : Device-specific factor
RANGE: Specified range
NO.: Manufacturing serial number
TAG NO. : Specified TAG No.

*1 The product - producing country

10.4 CSA

■ Technical Data

• Explosion Proof

Applicable Standard: C22.1-98, C22.2 No.0-M1991, C22.2 No.0.4-04, C22.2 No.0.5-1982, C22.2 No. 25-1966, C22.2 No. 30-M1986, C22.2 No. 94-M1991, C22.2 No. 142-M1987, C22.2 No. 61010-1-04, ANSI/ISA-12.27.01-2003

Certificate : 1166201

Type of Protection: Explosion proof for Class I, B, C and D; Class II, Groups E, F and G; Class III. For Class I, Division 2 location:

"FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."

Enclosure : Type 4X

(Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)

Temperature Code	Ambient Temperature	Process Temperature
T6	60°C	≤85°C
T5	60°C	≤100°C
T4	60°C	≤135°C
T3	60°C	≤200°C
T2	60°C	≤300°C
T1	60°C	≤450°C

Temperature Code: T6 (Remote Type Vortex Flow Converter)

Ambient Temperature: -29 to +60°C (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Detector)
-40 to +60°C (Remote Type Vortex Flow Converter)

Power Supply: 9 to 32Vdc (Integral Type Vortex Flowmeter and Remote Type Vortex Flow Converter)

Output Signal (Remote Type Vortex Flow Detector): Output Signal; 30Vp-p, 100μAp-p

Input/Output signal (Remote Type Vortex Flow Converter):
Input Signal; 30Vp-p, 100μAp-p

Electrical Connection: ANSI 1/2 NPT female (Special)

■ Dual Seal (Option /CF11)

Dual Seal:

Certified by CSA to the requirement of ANSI/ISA 12.27.01

No additional sealing required.

Primary seal failure annunciation: at the O-ring seal portion between shedder bar and amplifier housing.

10.5 TIIS

Certificate:

Model	Shedder bar Material	Integral Type Flowmeter		Remote Type Detector
		N (None Indicator)	D (With Indicator)	N (None Indicator)
DY015 DY025/R1 DY040/R2	E	TC14901	TC14912	TC14923
	X	TC18903	TC18914	TC18925
DY025 DY040/R1 DY050/R2	E	TC19504	TC19513	TC19522
	X	TC18904	TC18915	TC18926
DY040 DY050/R1 DY080/R2	E	TC19505	TC19514	TC19523
	X	TC18905	TC18916	TC18927
DY050 DY080/R1 DY100/R2	E	TC19506	TC19515	TC19524
	X	TC18906	TC18917	TC18928
DY080 DY100/R1 DY150/R2	E	TC19507	TC19516	TC19525
	X	TC18907	TC18918	TC18929
DY100 DY150/R1 DY200/R2	E	TC19508	TC19517	TC19526
	X	TC18908	TC18919	TC18930
DY150 DY200/R1	E	TC19509	TC19518	TC19527
	X	TC18909	TC18920	TC18931
DY200	E	TC19510	TC19519	TC19528
	X	TC18910	TC18921	TC18932
DY250	E	TC19511	TC19520	TC19529
DY300	E	TC19512	TC19521	TC19530
DY400	B	TC18945	TC18955	TC18965

Model	Shedder bar Material	Remote Type Converter	
		N (None Indicator)	D (With Indicator)
DYA		TC14934	TC14935

	Integral Type Flowmeter		Remote Type Flowmeter	
	None Indicator	With Indicator	Detector	Converter
Construction	Ex d IIC T6	←	←	←
	Flame Proof Approval	←	←	←
Amb.Temp	-20°C up to 60°C	←	←	←
Rating	Maximum power supply vortage: DC42V Current Signal: DC4-20mA Pulse Signal: ON : 2V 200mA OFF : 42V 4mA		Output Voltage: 30Vp-p Output Current: 100μ Ap-p	Maximum power supply vortage: DC42V Current Signal: DC4-20mA Pulse Signal: ON : 2V 200mA OFF : 42V 4mA Input Signal: 30V p-p,100μ A p-p Resistance Temp, Sensor Input: Pt1000 at 0°C Specified Current: less than 1mA

* In case that ambient temperature exceeds 50°C, use heat-resistant cables with maximum allowable temperature of 70°C or above.

APPENDIX 1. LIST OF PARAMETERS FOR EACH BLOCK OF digitalYEWFLO

Note: The Write Mode column contains the modes in which each parameter is write enabled.
O/S: Write enabled in O/S mode.
MAN: Write enabled in Man mode and O/S mode.
AUTO: Write enabled in Auto mode, Man mode, and O/S mode.
— : Write disabled

A1.1 Resource Block

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	1000	Block Header	TAG: “RS”	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	1001	ST_REV	—	—	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in this block is changed.
2	1002	TAG_DESC	(Spaces)	AUTO	The user description of the intended application of the block.
3	1003	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	1004	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	1005	MODE_BLK	—	AUTO	The actual, target, permitted, and normal modes of the block.
6	1006	BLOCK_ERR	0	—	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	1007	RS_STATE	—	—	State of the resource block state machine.
8	1008	TEST_RW	0	AUTO	Read/write test parameter-used only for conformance testing and simulation.
9	1009	DD_RESOURCE	(Spaces)	—	String identifying the tag of the resource which contains the Device Description for this resource.
10	1010	MANUFAC_ID	0x594543	—	Manufacturer identification number-used by an interface device to locate the DD file for the resource.
11	1011	DEV_TYPE	9	—	Manufacturer’s model number associated with the resource-used by interface devices to locate the DD file for the resource.
12	1012	DEV_REV	3	—	Manufacturer revision number associated with the resource-used by an interface device to locate the DD file for the resource.
13	1013	DD_REV	1	—	Revision of the DD associated with the resource-used by an interface device to locate the DD file for the resource.
14	1014	GRANT_DENY	—	AUTO	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block.
15	1015	HARD_TYPES	0x0001 (Scalar input)	—	The types of hardware available as channel numbers. bit0: Scalar input bit1: Scalar output bit2: Discrete input bit3: Discrete output
16	1016	RESTART	1	AUTO	Indicate the ways of restart 1: Run, 2: Restart resource, 3: Restart with defaults, and 4: Restart CPU processor.
17	1017	FEATURES	0x000a (Soft write lock supported Report supported)	—	Used to show supported resource block options.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
18	1018	FEATURE_SEL	0x000a (Soft write lock supported Report supported)	AUTO	Used to select resource block options. Bit0: Scheduled Bit1: Event driven Bit2: Manufacturer specified
19	1019	CYCLE_TYPE	0x0001(Scheduled)	—	Identifies the block execution methods available for this resource.
20	1020	CYCLE_SEL	0x0001(Scheduled)	AUTO	Used to select the block execution method for this resource.
21	1021	MIN_CYCLE_T	3200	—	Time duration of the shortest cycle interval of which the resource is capable.
22	1022	MEMORY_SIZE	0	—	Available configuration memory in the empty resource. To be checked before attempting a download.
23	1023	NV_CYCLE_T	0	—	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
24	1024	FREE_SPACE	0	—	Percent of memory available for further configuration. digitalYEWFLO has zero which means a preconfigured resource.
25	1025	FREE_TIME	0	—	Percent of the block processing time that is free to process additional blocks. Supported only with PID function.
26	1026	SHED_RCAS	640000 (20 s)	AUTO	Time duration at which to give up on computer writes to function block RCas locations. Supported only with PID function.
27	1027	SHED_ROUT	640000 (20 s)	AUTO	Time duration at which to give up on computer writes to function block ROut locations. Supported only with PID function.
28	1028	FAULT_STATE	1	—	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When fail-safe condition is set, Then output function blocks will perform their FSAFE actions. Supported only with PID function.
29	1029	SET_FSTATE	1 (OFF)	AUTO	Allows the fail-safe condition to be manually initiated by selecting Set. Supported only with PID function.
30	1030	CLR_FSTATE	1 (OFF)	AUTO	Writing a Clear to this parameter will clear the device fail-safe state if the field condition, if any, has cleared. Supported only with PID function.
31	1031	MAX_NOTIFY	3	—	Maximum number of unconfirmed notify messages possible.
32	1032	LIM_NOTIFY	3	AUTO	Maximum number of unconfirmed alert notify messages allowed.
33	1033	CONFIRM_TIME	640000 (20 s)	AUTO	The minimum time between retries of alert reports.
34	1034	WRITE_LOCK	1 (Not locked)	AUTO	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated. 1: Not locked, 2: Locked
35	1035	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
36	1036	BLOCK_ALM	—	—	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
37	1037	ALARM_SUM	—	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	1038	ACK_OPTION	0xffff	AUTO	
39	1039	WRITE_PRI	0	AUTO	Priority of the alarm generated by clearing the write lock. 0, 1, 3 to 15
40	1040	WRITE_ALM	—	—	This alert is generated if the write lock parameter is cleared.
41	1041	ITK_VER	5	—	Version number of interoperability test by Fieldbus Foundation applied to digitalYEWFLO.
42	1042	SOFT_REV	—	—	digitalYEWFLO software revision number.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
43	1043	SOFT_DESC		—	Yokogawa internal use.
44	1044	SIM_ENABLE_MSG	(Spaces)	AUTO	Software switch for simulation function.
45	1045	DEVICE_STATUS_1	—	—	Device status (VCR setting etc.)
46	1046	DEVICE_STATUS_2	—	—	Device status (failure or setting error etc.)
47	1047	DEVICE_STATUS_3	—	—	Device status (function block setting)
48	1048	DEVICE_STATUS_4	—	—	Device status (sensor status)
49	1049	DEVICE_STATUS_5	—	—	Device status (function block setting)
50	1050	DEVICE_STATUS_6	—	—	Not used for digitalYEWFLO
51	1051	DEVICE_STATUS_7	—	—	Not used for digitalYEWFLO.
52	1052	DEVICE_STATUS_8	—	—	Not used for digitalYEWFLO.
53	1053	SOFTDWN_ PROTECT	0x01	AUTO	Mask the software download function. 0x01:No masking 0x02:Masking
54	1054	SOFTDWN_ FORMAT	0x01	AUTO	Select the software download function format. 0x01:Conform to FF Specification
55	1055	SOFTDWN_COUNT	0x0000	—	Number of the execution times of the software download function.
56	1056	SOFTDWN_ACT_ AREA	0x00	—	Display he running Flash ROM number 0:Flash ROM#0 is running 1:Flash ROM#1 is running
57	1057	SOFTDWN_MOD_ REV	[0]:1, [1]-[7]:0	—	Display the module revision of the software.
58	1058	SOFTDWN_ERROR	0	—	Display the error at the software downloading.

A1.2 AI Function Block

Relative Index	Index			Parameter Name	Factory Default	Write Mode	Explanation
	AI1	AI2	AI3				
0	4000	4100	4200	Block Header	TAG: "AI1", "AI2" or "AI3"	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	4001	4101	4201	ST_REV	0	—	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	4002	4102	4202	TAG_DESC	(Spaces)	AUTO	The user description of the intended application of the block.
3	4003	4103	4203	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	4004	4104	4204	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	4005	4105	4205	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	4006	4106	4206	BLOCK_ERR	0	—	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	4007	4107	4207	PV	0	—	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.
8	4008	4108	4208	OUT	0	Value = MAN	The primary analog value calculated as a result of executing the function.
9	4009	4109	4209	SIMULATE	1 (Disabled)	AUTO	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status. 1=Disabled, 2=Active

Relative Index	Index			Parameter Name	Factory Default	Write Mode	Explanation
	AI1	AI2	AI3				
10	4010	4110	4210	XD_SCALE	Specified at the time of order (Note 3) (-40 to 260°C for AI2, 0 to 10m³/h for AI3)	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel. Refer to Section 6.3 "AI Function Block Parameters" for the unit available.
11	4011	4111	4211	OUT_SCALE	Specified at the time of order (Note 3) (-40 to 260°C for AI2, 0 to 10m³/h for AI3)	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT. Refer to Section 6.3 "AI Function Block Parameters" for the unit available.
12	4012	4112	4212	GRANT_DENY	0x00	AUTO	Options for controlling access of host computers and local control panels to operating, tuning and alarm parameters of the block.
13	4013	4113	4213	IO_OPTS	0x0000 (AI1) 0x0000 (AI2) 0x0000 (AI3)	O/S	Options which the user may select to alter input and output block processing. bit 6: Low cutoff
14	4014	4114	4214	STATUS_OPTS	0	O/S	Options which the user may select in the block processing of status. bit 3: Propagate Failure Forward, bit 6: Uncertain if Man mode, bit 7: Bad if limited, bit 8: Uncertain if Man mode.
15	4015	4115	4215	CHANNEL	1 (AI1) 2 (AI2) 5 (AI3)	O/S	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world. AI1: Flow rate, AI2: Temperature, AI3: Volumetric flow rate.
16	4016	4116	4216	L_TYPE	Direct (1)	MAN	Determines if the values passed by the transducer block to the AI block may be used directly (Direct (1)) or if the value is in different units and must be converted linearly (Indirect (2)), or with square root (Ind Sqr Root (3)), using the input range defined by the transducer and the associated output range. "Indirect Square Root" is not used for the digitalYEWFLO.
17	4017	4117	4217	LOW_CUT	0.0 (AI1) 0.0 (AI2) 0.0 (AI3)	AUTO	Sets low cut point of output. This low cut value become available by setting "Low cutoff" to "IO-OPTS".
18	4018	4118	4218	PV_FTIME	0sec (AI1) 0sec (AI2) 0sec (AI3)	AUTO	Time constant of a single exponential filter for the PV, in seconds.
19	4019	4119	4219	FIELD_VAL	—	—	Raw value of the field device in percent of the PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE), filtering (PV_FTIME), or low cut (LOW_CUT).
20	4020	4120	4220	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
21	4021	4121	4221	BLOCK_ALM	—	—	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
22	4022	4122	4222	ALARM_SUM	—	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
23	4023	4123	4223	ACK_OPTION	0xffff	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
24	4024	4124	4224	ALARM_HYS	0.5%	AUTO	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percent of the PV span. 0 to 50
25	4025	4125	4225	HI_HI_PRI	0	AUTO	Priority of the high high alarm. 0, 1, 3 to 15
26	4026	4126	4226	HI_HI_LIM	1. #INF	AUTO	The setting for high high alarm in engineering units. (Note 1)
27	4027	4127	4227	HI_PRI	0	AUTO	Priority of the high alarm. 0, 1, 3 to 15

Relative Index	Index			Parameter Name	Factory Default	Write Mode	Explanation
	AI1	AI2	AI3				
28	4028	4128	4228	HI_LIM	1. #INF	AUTO	The setting for high alarm in engineering units. (Note 1)
29	4029	4129	4229	LO_PRI	0	AUTO	Priority of the low alarm. 0, 1, 3 to 15
30	4030	4130	4230	LO_LIM	-1. #INF	AUTO	The setting for the low alarm in engineering units. (Note 2)
31	4031	4131	4231	LO_LO_PRI	0	AUTO	Priority of the low low alarm. 0, 1, 3 to 15
32	4032	4132	4232	LO_LO_LIM	-1. #INF	AUTO	The setting of the low low alarm in engineering units. (Note 2)
33	4033	4133	4233	HI_HI_ALM	—		The status for high high alarm and its associated time stamp.
34	4034	4134	4234	HI_ALM	—		The status for high alarm and its associated time stamp.
35	4035	4135	4235	LO_ALM	—		The status of the low alarm and its associated time stamp.
36	4036	4136	4236	LO_LO_ALM	—		The status of the low low alarm and its associated time stamp.
37	4037	—	4237	TOTAL	0	—	Indicates the totalized flow rate.
38	4038	—	4238	TOTAL_START	1 (Stop)	AUTO	Starts/stops the totalizer.
39	4039	—	4239	TOTAL_RATE_VA	1	O/S	Totalization rate (Note 4)
40	4040	—	4240	TOTAL_RESET	1 (Off)	AUTO	Resets the totalized flow rate. This parameter value reverts to 1 (Off) after it has been set to 2 to perform resetting.

Note 1: An intended set value can be written only if Min(OUT_SCALE.EU0, OUT_SCALE.EU100) ≤ the intended value ≤ +INF.
Note 2: An intended set value cannot be written if –INF ≤ the intended value ≤ Min(OUT_SCALE.EU0, OUT_SCALE.EU100).
Note 3: Indicates the corresponding data for the temperature.
Note 4: The setting range of TOTAL_RATE_VAL is above 0 and its unit is determined by the setting in the Units Index element of XD_SCALE. For example, if m^3/h is set in Units Index of XD_SCALE, then the unit of TOTAL_RATE_VAL is m^3/p (square meters per pulse), or if kg/s is set in Units Index of XD_SCALE, the unit of TOTAL_RATE_VAL is kg/p. Nevertheless, for TOTAL_RATE_VAL, set a power of ten such as 0.1, 1, 10, or 100. If any other number is set, the totalizer reading on the LCD indicator shows the totalized pulse count without the unit.

A1.3 Transducer Block

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	2000	Block Header	TAG: "TB"	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	2001	ST_REV	—	—	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	2002	TAG_DESC	(Spaces)	AUTO	The user description of the intended application of the block
3	2003	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	2004	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	2005	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	2006	BLOCK_ERR	0	—	This parameter reflects the error status. The factors of digitalYEWFLO TR Block are; *Error of TB block. *TR block is on O/S mode.
7	2007	UPDATE_EVT	—	—	This alert is generated by any change to the static data.
8	2008	BLOCK_ALM	—	—	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute.
9	2009	TRANSDUCER_ DIRECTORY	1, 2010	—	A directory that specifies the number and starting indices of the device.
10	2010	TRANSDUCER_ TYPE	Standard Flow with Calibration (104)	—	Identifies the device type, which is “Standard Flow with Calibration” for the digitalYEWFLO.
11	2011	XD_ERROR	0 (No Error)	—	Indicates the error code of the error of the highest priority from among the errors currently occurring in the transducer block.
12	2012	COLLECTION_ DIRECTORY	3, 2013, 0x80020380 2028, 0x80020382, 2031, 0x30003	—	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block.
13	2013	PRIMARY_ VALUE_ TYPE	Volumetric flow (101)	O/S	The type of measurement represented by the primary value. Followings are available for the digitalYEWFLO: 100=mass flow, 101=volumetric flow
14	2014	PRIMARY_ VALUE	—	—	Indicates the flow rate.
15	2015	PRIMARY_ VALUE_ RANGE	(Note 1)	—	Indicates the flow range. These values are converted the values of SENSOR_ RANGE by the unit of XD_SCALE and the data of LINE_ SIZE.
16	2016	CAL_POINT_HI	Max. range (Note 2)	O/S	The highest calibrated value. To set within the range of SENSOR_RANGE.
17	2017	CAL_POINT_LO	Min. range (Note 3)	O/S	The lowest calibrated value. To set within the range of SENSOR_RANGE.
18	2018	CAL_MIN_SPAN	(Note 1)	—	The minimum calibration span value allowed.
19	2019	CAL_UNIT	m^3/h (1349) (Note 4)	O/S	The engineering unit for the calibrated values. Refer to Table 6.2 for the unit available.
20	2020	SENSOR_TYPE	Vortex (112)	—	Indicates the sensor type, which is “Vortex” for the digitalYEWFLO.
21	2021	SENSOR _RANGE	(Note 1)	—	The high and low range limit values, engineering units code and the number of digits to the right of the decimal point for the sensor.
22	2022	SENSOR_SN	Serial No.	—	Serial number.
23	2023	SENSOR_CAL _METHOD	volumetric (100)	O/S	The method of the last sensor calibration. 100=volumetric 101=static weight
24	2024	SENSOR_CAL _LOC	—	O/S	Sets/indicates the location of the last sensor calibration.
25	2025	SENSOR_CAL _DATE	—	O/S	Sets/indicates the date of the last sensor calibration.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
26	2026	SENSOR_CAL _WHO	—	O/S	Sets/indicates the name of the person responsible for the last sensor calibration.
27	2027	LIN_TYPE	linear with input (1)	—	The linearization type of sensor output. digitalYEWFLO is "linear with input".
28	2028	SECONDARY _VALUE	0	O/S	Temperature value.
29	2029	SECONDARY _VALUE_UNIT	°C (1001)	O/S	Temperature value unit of AI2. The unit is linked to the unit of XD_SCALE.
30	2030	PRIMARY_ VALU E_FTIME	4 s	AUTO	Sets the time constant of damping for the flow rate calculation. Setting range: 0 to 99 s.
31	2031	TERTIARY _VALUE	0	—	Indicates the totalized flow rate and its status.
32	2032	TERTIARY _VALUE_ UNIT	—	O/S	Indicates the unit of the totalized flow rate; switches over in line with a change to the unit setting in XD_SCALE, among 1034 (m^3), 1038 (L), 1088 (kg), 1092 (t), 1521 (Nm^3), 1531 (NL), Sm^3 (1526), and 1536 (SL). N: Normal, S: Standard
33	2033	LIMSW_1_VALUE _D	—	—	Indicates the value of limit switch 1, which switches ON and OFF depending on the digital value of the target input parameter selected in LIMSW_1_TARGET and based on the threshold set in LIMSW_1_SETPOINT with the hysteresis set in LIMSW_1_HYSTERESIS. The direction of the switching action is determined by the setting in LIMSW_1_ACT_DIRECTION.
34	2034	LIMSW_1 _TARGET	1 (PRIMARY_ VALUE)	O/S	The target of limit switch 1: 1 = PRIMARY_VALUE 2 = SECONDARY_VALUE
35	2035	LIMSW_1 _ SETPOINT	0	O/S	Sets the threshold of limit switch 1. If the value of LIMSW_1_ACT_DIRECTION is HIGH LIMIT, limit switch 1 turns ON when LIMSW_1_TARGET has gone beyond LIMSW_1_SETPOINT. If the value of LIMSW_1_ ACT_DIRECTION is LO LIMIT, limit switch 1 turns ON when LIMSW_1_TARGET has gone below LIMSW_1_ SETPOINT. The unit set in LIMSW_1_UNIT applies.
36	2036	LIMSW_1_ACT _DIRECTION	1 (HI LIMIT)	O/S	Selects the direction of the limit switch 1's actions: 1 = HI LIMIT (high-limit switch) 2 = LO LIMIT (low-limit switch)
37	2037	LIMSW_1 _ HYSTERESIS	0	O/S	Sets the hysteresis of limit switch 1 to be applied for resetting the LIMSW_1_VALUE_D to OFF after LIMSW_1_TARGET went beyond LIMSW_1_SETPOINT and LIMSW_1_VALUE_D turned ON (when used as a high-limit switch), or after LIMSW_1_TARGET went below LIMSW_1_SETPOINT and LIMSW_1_VALUE_D turned ON (when used as a low-limit switch).
38	2038	LIMSW_1_UNIT	—	—	Indicates the unit set in LIMSW_1_TARGET.
39	2039	LIMSW_2_VALUE _D	—	—	Indicates the value of limit switch 2, which switches ON and OFF depending on the digital value of the target input parameter selected in LIMSW_2_TARGET and based on the threshold set in LIMSW_2_SETPOINT with the hysteresis set in LIMSW_2_HYSTERESIS. The direction of the switching action is determined by the setting in LIMSW_2_ACT_DIRECTION.
40	2040	LIMSW_2 _TARGET	1 (PRIMARY_ VALUE)	O/S	The target of limit switch 2: 1 = PRIMARY_VALUE 2 = SECONDARY_VALUE
41	2041	LIMSW_2 _ SETPOINT	0	O/S	Sets the threshold of limit switch 2. If the value of LIMSW_2_ACT_DIRECTION is HIGH LIMIT, limit switch 2 turns ON when LIMSW_2_TARGET has gone beyond LIMSW_2_SETPOINT. If the value of LIMSW_2_ ACT_DIRECTION is LO LIMIT, limit switch 2 turns ON when LIMSW_2_TARGET has gone below LIMSW_2_ SETPOINT. The unit set in LIMSW_2_UNIT applies.
42	2042	LIMSW_2_ACT _DIRECTION	1 (HI LIMIT)	O/S	Selects the direction of the limit switch 2's actions: 1 = HI LIMIT (high-limit switch) 2 = LO LIMIT (low-limit switch)

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
43	2043	LIMSW_2 _ HYSTERESIS	0	O/S	Sets the hysteresis of limit switch 2 to be applied for resetting the LIMSW_2_VALUE_D to OFF after LIMSW_2_TARGET went beyond LIMSW_2_SETPOINT and LIMSW_2_VALUE_D turned ON (when used as a high-limit switch), or after LIMSW_2_TARGET went below LIMSW_2_SETPOINT and LIMSW_2_VALUE_D turned ON (when used as a low-limit switch).
44	2044	LIMSW_2_UNIT	—	—	Indicates the unit set in LIMSW_2_TARGET.
45	2045	ALARM _PERFORM	0x1070	AUTO	A series of bits, each of which works as a switch to enable and disable specific alarm(s); write zeros to the respective bits in this parameter to disable desired alarms. (For details, refer to APPENDIX 3 "OPERATION OF EACH PARAMETER IN FAILURE MODE.")
46	2046	ARITHMETIC _BLOCK	1 (Available)	—	Indicates whether the arithmetic block is available.
47	2047	SENSOR_STATUS	—	—	Indicates whether the flow detector has the built-in temperature sensor: 1 = Standard 2 = Built-in Temp. Sensor
48	2048	THERMOMETER _FUNCTION	1 (Monitor only) (Note 5)	O/S	Selects the usage of the thermometer function: 1 = Monitor only 2 = Saturated steam 3 = Superheat steam 4 = GAS: STD/Normal 5 = LIQUID: Mass 6 = Not use (For details, refer to Section 6.2 "Transducer Block Parameters.")
49	2049	FLUID_TYPE	1 (LIQUID: Volume) (Note 5)	O/S	Selects the type of the measured process fluid: 1 = LIQUID: Volume 2 = GAS/STEAM: Volume 3 = LIQUID: Mass 4 = GAS/STEAM: Mass 5 = GAS: STD/Normal
50	2050	TEMPERATURE _UNIT	°C (1001) (Note 5)	O/S	Selects the unit of temperature.
51	2051	PROCESS_TEMP	15 (Note 5)	O/S	Sets the normal operating temperature of the process. Setting range: –999.9 to 999.9
52	2052	BASE_TEMP	15 (Note 5)	O/S	Sets the temperature under the standard conditions of the process. Setting range: from –999.9 to 999.9
53	2053	DENSITY_UNIT	Kg/m^3 (1097) (Note 5)	O/S	Selects the unit of density.
54	2054	PROCESS _ DENSITY	1024 (Note 5)	O/S	Sets the density of the process fluid under the normal operating conditions. Setting range: 0.00001 to 32000
55	2055	BASE_DENSITY	1024 (Note 5)	O/S	Sets the density of the process fluid under the standard operating conditions. Setting range: 0.00001 to 32000
56	2056	PRESSURE_UNIT	MPaa (1545) (Note 5)	O/S	Selects the unit of pressure between 1545 (= MPaa) and 1547 (= kPaa).
57	2057	PROCESS _ PRESSURE	0.1013 (Note 5)	O/S	Sets the normal operating absolute pressure of the process. Setting range: 0.00001 to 32000
58	2058	BASE _PRESSURE	0.1013 (Note 5)	O/S	Sets the absolute pressure under the standard conditions of the process. Setting range: 0.00001 to 32000
59	2059	DEVIATION	1 (Note 5)	O/S	Sets the deviation factor of the process fluid. Setting range: 0.001 to 10.0
60	2060	SECONDARY _VALUE_FTIME	4 s	AUTO	Sets the time constant of damping for the temperature calculation. Setting range: 0 to 99 s
61	2061	CABLE_LENGTH	0	O/S	Sets the length of cable between the flow detector and remote amplifier. Set 0 for an integral type digitalYEWFLO. Setting range: 0 to 30 (meters)
62	2062	FIRST_TEMP _COEF	0	O/S	Sets the first temperature coefficient for the density compensation of a liquid. Setting range: –32000 to 32000 Unit: 1/TEMP_UNIT

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
63	2063	SECOND_TEMP _COEF	0	O/S	Sets the second temperature coefficient for the density compensation of a liquid. Setting range: –32000 to 32000 Unit: 1/TEMP_UNIT^2
64	2064	SIZE_SELECT	25 mm (2) (Note 5)	O/S	Selects the flowmeter size: 1 = 15 mm (1/2 in.); 2 = 25 mm (1 in.); 3 = 40 mm (1.5 in.); 4 = 50 mm (2 in.); 5 = 80 mm (3 in.); 6 = 100 mm (4 in.); 7 = 150 mm (6 in.); 8 = 200 mm (8 in.); 9 = 250 mm (10 in.); 10 = 300 mm (12 in.); 11 = 400 mm (16 in.)
65	2065	BODY_TYPE	Standard (1)	O/S	Selects the flowmeter body type: 1 = Standard; 2 = High Pressure; 3 = Low Flow Unit (1); 4 = Low Flow Unit (2)
66	206	VORTEX _ SENSOR_TYPE	Standard (1)	O/S	Selects the vortex sensor type: 1 = Standard; 2 = High Temperature; 3: Low temperature.
67	2067	K_FACTOR_UNIT	p/L (1)	O/S	Selects the unit of the K factor.
68	2068	K_FACTOR	68.6	O/S	Sets the K factor of the combined detector at 15°C. Setting range: 0.00001 to 32000
69	2069	LOW_CUT_FLOW	0.46687 (minimum gas flow rate for the size of 25 mm [1 in.])	O/S	Sets the low cutoff flow rate level. Setting range: Minimum flow rate x 0.5 to XD_SCALE.EU_100. The unit selected in PRIMARY_VALUE_RANGE.Units Index applies.
70	2070	UPPER_DISPLAY _MODE	1	AUTO	Selects the data to be displayed on the upper row of the LCD indicator: 1 = Flow Rate (%): Instantaneous flow rate as a percentage 2 = Flow Rate: Instantaneous flow rate in the specified unit 3 = Temperature (%): Temperature as a percentage (can only be selected for a mode with the MV option) 4 = Arithmetic Out
71	2071	LOWER_DISPLAY _MODE	1	AUTO	Selects the data to be displayed on the upper row of the LCD indicator, as follows: 1 = Blank 2 = Total: Totalized flow rate 3 = Temperature: Temperature (can only be selected for a mode with the MV option) 4 = Integrator Out
72	2072	DISPLAY_CYCLE	1 (500 ms)	O/S, AUTO	Sets the display refresh cycle of the LCD indicator, as a multiple of 500 milliseconds. Setting range: 1 to 10 (= 0.5 to 5 seconds)
73	2073	USER_ADJUST	1	O/S	User-set adjustment factor. The measured flow rate multiplied by this factor is output. Setting range: 0.00001 to 32000
74	2074	REYNOLDS _ADJUST	1 (Not Active)	O/S	Selects whether to activate Reynolds number correction: 1 = Not Active; 2 = Active
75	2075	VISCOSITY _VALUE	1 (Note 5)	O/S	Sets the viscosity coefficient of the process fluid. When REYNOLDS_ADJUST is set to Active, this parameter needs to be set since it is used in the Reynolds number calculation. Setting range: 0.00001 to 32000 [mPa•Pas]
76	2076	GAS_EXPANSION _FACT	1 (Not Active)	O/S	Selects whether to activate expansion correction for a compressible fluid: 1 = Not Active; 2 = Active
77	2077	FLOW_ADJUST	1 (Not Active)	O/S	Selects whether to activate instrument error correction for a compressible fluid: 1 = Not Active; 2 = Active
78	2078	FLOW_ADJ _FREQ	0	O/S	Sets the first to fifth breakpoint frequencies for the instrument error correction in an array format. Setting range: 0.0 to 32000 (unit is Hz [1077])
79	2079	FLOW_ADJ_DATA	0	O/S	Sets the correcting values corresponding to the first to fifth breakpoint frequencies for the instrument error correction in an array format. Setting range: –50.00 to 50.00 (unit is % [1342])
80	2080	TRIGGER_LEVEL	1	O/S	Sets the trigger level. Setting range: 0.1 to 20.0
81	2081	NOISE_BALANCE _MODE	1 (Auto)	O/S	Indicates the mode of noise balance ratio tuning and allows tuning to be activated: 1 = Auto: Automatic noise balance mode 2 = Manual: Manual noise balance mode 3 = Tuning at Zero: Setting this value causes noise balance ratio to be tuned given that the current flow rate is zero; then after completion of the tuning, the parameter value reverts to 2 (Manual).

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
82	2082	NOISE_RATIO	—	—	Indicates the noise balance ratio. When the value of NOISE_BALANCE_MODE is 1 (Auto), this value cannot be modified. When it is 2 (Manual), the desired value can be set as a fixed ratio.
83	2083	SIGNAL_LEVEL	1	O/S	Sets the signal level. Setting range: 0.1 to 20.0
84	2084	FLOW_VELOCITY	—	—	Indicates the current flow velocity in m/s (1061); updated periodically.
85	2085	SPAN_VELOCITY	—	—	Indicates the span flow velocity in m/s (1061); updated periodically. (This parameter is set to the value calculated based on the density under the normal operating conditions and normal operating temperature specified by the customer.)
86	2086	VORTEX _ FREQUENCY	—	—	Indicates the current vortex generation frequency in Hz (1077); updated periodically.
87	2087	SPAN_FREQ	—	—	Indicates the vortex generation frequency at the span flow in Hz (1077); updated periodically. (This parameter is set to the value calculated based on the density under the normal operating conditions and normal operating temperature specified by the customer.)
88	2088	FLUID_DENSITY	—	—	Indicates the fluid density calculated based on the temperature data, in the unit determined by DENSITY_ UNIT; updated periodically.
89	2089	SENSOR _ERROR _RECORD	0	O/S, AUTO	Record of the following errors regarding the sensor. This record will be automatically cleared when no error has occurred for a month. Recorded errors: Flow over output, Span set error, Pre-amp fault, EEPROM fault, Sensor fault, Transient noise, High vibration, Clogging, Fluctuating, Temp over output, Over temp, Temp sensor fault, Temp convert fault. Setting range: 0 only. Setting 0 clears the record.
90	2090	MODEL	digitalYEWFLO	O/S, AUTO	Model of the flowmeter converter
91	2091	ALARM_SUM	0	O/S, AUTO	Indicates the entire block's alarm statuses; Disable can only be set.
153	2153	VOLUME_FLOW	—	—	Indicates the volumetric flow rate.
154	2154	VOLUME _FLOW_ UNIT	—	—	Indicates the unit of VOLUME_FLOW. It links the unit of XD_SCALE of AI3.

Note 1: The value changes in line with a change to the SIZE_SELECT value or to the unit setting in XD_SCALE of the corresponding AI block.
Note 2: An intended value which meets both of the following conditions can only be written: CAL_POINT_LO < the intended value, and SENSOR_RANGE.EU100 > intended value.
Note 3: An intended value which meets both of the following conditions can only be written: CAL_POINT_HI < the intended value, and SENSOR_RANGE.EU100 > intended value.
Note 4: The flow rate unit can only be written.
Note 5: These parameters are set in accordance with the specifications written in the registered sizing data if it is supplied. In case of UNCALIBRATION order, they are set to the defaults when shipped.

A1.4 DI Function Block

Relative Index	Index		Parameter Name	Factory Default	Write Mode	Explanation
	DI1	DI2				
0	6000	6100	Block Header	TAG: "DI1" or "DI2"	Block Tag = O/S	Information on this block such as the block tag, DD revision, and execution time
1	6001	6101	ST_REV	0	—	The revision level of the static data of the DI block. The value of this parameter is incremented each time a static parameter value is changed.
2	6002	6102	TAG_DESC	(Spaces)	AUTO	The user description of the intended application of the block
3	6003	6103	STRATEGY	1	AUTO	Used by an upper-level system to identify grouping of the block. Not checked or processed by the block.
4	6004	6104	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms.
5	6005	6105	MODE_BLK	O/S	AUTO	The actual, target, permitted, and normal modes of the block
6	6006	6106	BLOCK_ERR	—	—	Indicates the error statuses related to the block itself.
7	6007	6107	PV_D	—	—	The primary discrete value (or process value) for execution of the block's functions.
8	6008	6108	OUT_D	—	MAN	Indicates the value and status of block's output.
9	6009	6109	SIMULATE_D	1 (Disabled)	AUTO	Allows use of values manually set instead of the limit switch input from the transducer block. When Disable is set for this value, the block reflects the actual input value and status. 1 = Disabled, 2 = Active
10	6010	6110	XD_STATE	0	—	Not used in a digitalYEWFLO.
11	6011	6111	OUT_STATE	0	—	Not used in a digitalYEWFLO.
12	6012	6112	GRANT_DENY	0	AUTO	Option to control access from the host computer and local control panel to tuning and alarm parameters. Before write access to a parameter, set the GRANT bit in this parameter to have the operation right to be granted. Then after write access, check the DENY bit in this parameter. If the write access is complete successfully, it is not ON.
13	6013	6113	IO_OPTS	0	O/S	Sets the block input/output options.
14	6014	6114	STATUS_OPTS	0	O/S	Defines block actions depending on block status conditions. For DI blocks of a digitalYEWFLO, only bit 0 (Invert: on/off state inversion) is effective.
15	6015	6115	CHANNEL	3 (DI1) 4 (DI2)	O/S	The channel number of the transducer block's logical hardware channel connected to this block. Fixed to 3 for DI1, 4 for DI2 in the DI blocks of a digitalYEWFLO.
16	6016	6116	PV_FTIME	0 s	AUTO	Sets the time constant of damping for PV_D.
17	6017	6117	FIELD_VAL_D	—	—	The status of the limit switch signal transferred from the transducer block
18	6018	6118	UPDATE_EVT	—	—	Shows the contents of an update event (a change to the setpoint) upon occurrence.
19	6019	6119	BLOCK_ALM	—	—	Shows the contents of a block alarm upon occurrence.
20	6020	6120	ALARM_SUM	0	AUTO	Indicates the current alarm statuses.
21	6021	6121	ACK_OPTION	0xffff (Unack)	AUTO	Selects whether alarms associated with the block will be automatically acknowledged.
22	6022	6122	DISC_PRI	0	AUTO	Sets the alarm priority level.
23	6023	6123	DISC_LIM	0	AUTO	Indicates the status of the input for the discrete alarm.
24	6024	6124	DISC_ALM	—	—	Indicates the status related to the discrete alarm.

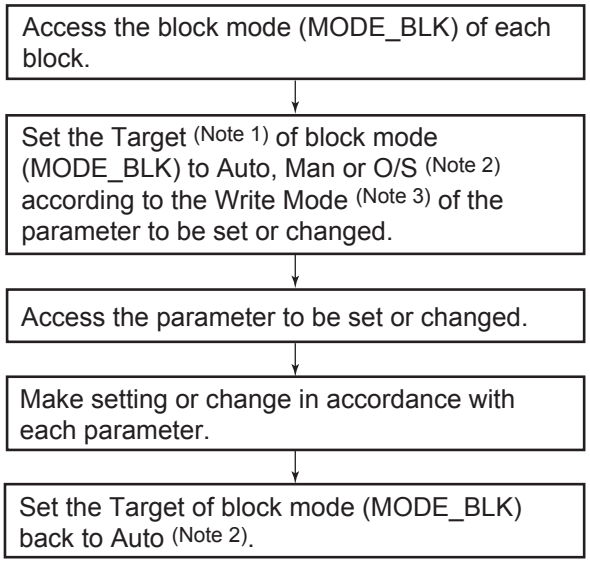
APPENDIX 2. APPLICATION, SETTING AND CHANGE OF BASIC PARAMETERS

A2.1 Applications and Selection of Basic Parameters

Setting Item (applicable parameters)	Summary
Tag numbers (PD-TAG)	Set the physical device (PD) tag and block tags. Up to 32 alphanumeric characters can be set for each of these tags. Refer to Section 5.4 “Setting of Tags and Addresses.”
Calibration range setup (XD_SCALE of AI block)	Sets the range of input from the transducer block corresponding to the 0% and 100% points in operation within the AI1 function block. The maximum flow rate range in the registered sizing data is the factory default setting. Set four data: the unit of the range, the input value at the 0% point (always 0 for a digitalYEWFLO), the input value at the 100% point (equal to the flow span), and the decimal point position.
Output scale setup (OUT_SCALE of AI block)	Set the scale of output corresponding to the 0% and 100% points in operation within the AI function block. It is possible to set a unit and scale that differ from the measurement range. Set four data: the unit of the scale, the output value at the 0% point (i.e., the lower output scale limit), the output value at the 100% point (i.e., the upper output scale limit), and the decimal point position.
Output mode setup (L_TYPE of AI block)	Select the calculation function of each AI function block from the following: • Direct: The output of the transducer block is directly output only via filtering without scaling and square root extraction (in the range set in XD_SCALE). • Indirect: Proportional scaling is applied to the input to the AI function block, and the result is output (in the range set in OUT_SCALE). • IndirectSQRT: Square root extraction is applied to the input to the AI function block and the result is output (in the range set in OUT_SCALE). This setting is not used for a digitalYEWFLO. This output mode setting also applies to the scale and unit of indications on the LCD indicator.
Damping time constant setup (PRIMARY_VALUE_FTIME of TR block)	Set the time constant of damping in seconds. The setting of PRIMARY_VALUE_FTIME affects not only the flow rate but also the totalization. In comparison, the setting of parameter PV_FTIME in an AI function block works as the damping time constant for the AI block’s OUT. As the damping feature of the flowmeter itself, it is advisable to use PRIMARY_VALUE_FTIME.
Output signal low cut mode setup (LOW_CUT_FLOW of TR block)	This setup is used for zeroing flow rate readings in a low flow rate area. The value of LOW_CUT_FLOW (the cutoff level) is set in the same unit as that for PRIMARY_VALUE_RANGE. In comparison, the setting of parameter LOW_CUT in an AI function block works as a low cutoff level setting for the AI block’s OUT. As the low cutoff feature of the flowmeter itself, it is advisable to use LOW_CUT_FLOW.
Simulation setup (SIMULATE of AI/DI block)	Simulation of each AI/DI block can be performed in such a way that the value and status of the input to the block can be set arbitrarily. Use this function for loop checks or the like. Refer to Section 7.3 “Simulation Function. ”
LOD display setup (UPPER_DISPLAY_MODE, LOWER_DISPLAY_MODE, and DISPLAY_CYCLE of TR block)	Set the units of data to be displayed on the LCD, and the display refresh cycle. Adjust DISPLAY_CYCLE to improve legibility such as when used in a low temperature environment causing hard-to-read indications.
Calibration range change (CAL_POINT_HI and CAL_POINT_LO of TR block)	Set the 0% and 100% points for calibrations, i.e., the calibration range. The output can be calibrated precisely to the output of a user’s reference device.

A2.2 Setting and Change of Basic Parameters

This section describes the procedure taken to set and change the parameters for each block. Obtaining access to each parameter differs depending on the configuration system used. For details, refer to the instruction manual for each configuration system.



FA0201.ai

IMPORTANT

Do not turn the power OFF immediately after parameter setting. When the parameters are saved to the EEPROM, the redundant processing is executed for the improvement of reliability. If the power is turned OFF within 60 seconds after setting of parameters, changed parameters are not saved and may return to their original values.

Note 1: Block mode consists of the following four modes that are controlled by the universal parameter that displays the running condition of each block.
Target: Sets the operating condition of the block.
Actual: Indicates the current operating condition.
Permit: Indicates the operating condition that the block is allowed to take.
Normal: Indicates the operating condition that the block will usually take.

Note 2: The followings are the operating conditions which the individual blocks will take.

	AI Function Block	Transducer Block	Resource Block	DI Function Block
Automatic (Auto)	Yes	Yes	Yes	Yes
Manual (Man)	Yes			Yes
Out of Service (O/S)	Yes	Yes	Yes	Yes

Note 3: Refer to APPENDIX 1 “LIST OF PARAMETERS FOR EACH BLOCK OF digital YEWFLO” for details of the Write Mode for each block.

A2.3 Setting the AI Function Blocks

Each digtalYEWFLO contains three AI function blocks (AI1, AI2 and AI3) having independent parameters. Set up the parameters of each AI block you use, individually as necessary.
The AI1 block performs the flow rate output calculation (standard).

(1)-1. Setting the calibration range

Access the XD_SCALE parameter.
Set the required unit in Unit Index of XD_SCALE.
Set the upper range limit in EU at 100% of XD_SCALE.
Set the lower range limit in EU at 0% of XD_SCALE.
Set the decimal point position in Decimal Point of XD_SCALE.

FA0202.ai

Example:
To measure 0 to 100m^3/h,
Set m^3/h (1349)*1 in Units Index of XD_SCALE,
Set 100 in EU at 100% of XD_SCALE, and
Set 0 in EU at 0% of XD_SCALE.

(1)-2. Setting the output scale

Access the OUT_SCALE parameter.
Set the required unit in Unit Index of OUT_SCALE.
Set the output value corresponding to the upper range limit in EU at 100% of OUT_SCALE.
Set the output value corresponding to the lower range limit in EU at 0% of OUT_SCALE.
Set the decimal point position in Decimal Point of OUT_SCALE.

FA0203.ai

Example:
To set the output range to 0.00 to 100.00kg/h,
Set kg/h(1324)*1 in Units Index of OUT_SCALE,
Set 100 in EU at 100% of OUT_SCALE,
Set 0 in EU at 0% of OUT_SCALE,
and Set 2 in Decimal Point of OUT_SCALE.
The AI2 block performs the temperature output calculation (option /MV).

(2)-1. Setting the calibration range

Access the XD_SCALE parameter.
Set the upper range limit in EU at 100% of XD_SCALE.
Set the lower range limit in EU at 0% of XD_SCALE.
Set the required unit in Unit Index of XD_SCALE.

FA0204.ai

Example:
To measure 0 to 200°C,
Set EU at 100% of XD_SCALE to 200.
Set EU at 0% of XD_SCALE to 0.
Set Unit Index of XD_SCALE to 1001.*1

(2)-2. Setting the output scale

Access the OUT_SCALE parameter.
Set the output value corresponding to the upper range limit in EU at 100% of OUT_SCALE.
Set the output value corresponding to the lower range limit in EU at 0% of OUT_SCALE.
Set the required unit in Unit Index of XD_SCALE.

FA0205.ai

Example:
To set the output range to 0 to 100%,
Set EU at 100% of XD_SCALE to 100.
Set EU at 0% of XD_SCALE to 0.
Set Unit Index of XD_SCALE to 1342.*1

*1: Each unit is expressed using a 4-digit numeric code. Refer to Table 6.2 and Section 6.5 “Integral LCD Indicator”

(3) Setting the output mode

Access the L_TYPE parameter.
Set the output mode.
1: Direct (Sensor output value)
2: Indirect (Linear output value)
3: IndirectSQRT (Square root extraction output value)*1

*1: IndirectSQRT is not used for the digitalYEWFLO.

FA0206.ai

(4) Simulation

Perform simulation of each AI function block by setting the desired value and status of the input to the block.

REMOTE LOOP TEST SWITCH is written to SIM_ENABLE_MSG (index 1044) parameter of the resource block.

↓

Access the En/Disable element of the SIMULATE parameter to enable simulation.
1: Disabled
2: Active

↓

Access the SIMULATE Status element of SIMULATE and set the desired status code.

↓

Access the SIMULATE Value element of SIMULATE and set the desired input value.

FA0207.ai

If simulation is enabled, AI block uses SIMULATE Status and SIMULATE Value as the input, and if disabled, the AI block uses Transducer Status and Transducer Value as input.
Refer to Section 7.3 “Simulation Function.”

A2.4 Setting the Transducer Block

To access the digitalYEWFLO-specific functions in the transducer block, the Device Description (DD) for the digitalYEWFLO needs to have been installed in the configuration tool used. For installation, refer to Section 4.4 “Integration of DD.”

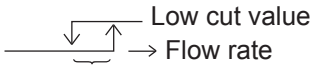
(1) Setting the damping time constant

Access the PRIMARY_VALUE_FTIME parameter.
Set the damping time constant (in units of seconds).

FA0208.ai

(2) Setting the output low cutoff level

Access the OUTPUT_CUT_FLOW parameter.
Set the cutoff level of the flow rate output.



Hysteresis 20%

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(3) Setting the limit switch functions

Set up limit switches 1 and 2. Limit switch statuses can be read from a host as outputs of DI blocks.

Access the LIMSW_1_TARGET parameter and select the flow rate or temperature to be monitored by limit switch 1.

1: PRIMARY_VALUE	Flow rate
2: SECONDARY_VALUE	Temperature

↓

Access the LIMSW_1_ACT_DIRECTION parameter and select the direction of limit switch 1’s actions.

1: HI LIMIT	High limit switch
2: LO LIMIT	Low limit switch

↓

Access the LIMSW_1_SETPOINT parameter and set the threshold for turning on limit switch 1. As necessary, the on/off hysteresis can be modified by changing the value of the LIMSW_1_HYSTERESIS parameter (only a positive value can be set).

FA0210.ai

The above shows the setting procedure for limit switch 1. As necessary, also set up limit switch 2.

(4) Setting up the LCD display

Select the data to be displayed on the LCD indicator and the display refresh cycle.

First, select the data to be displayed on the upper row of the LCD. Access the UPPER_DISPLAY_MODE parameter and select an item.

1: Flow Rate (%)	Instantaneous flow rate as a percentage
2: Flow Rate	Instantaneous flow rate in the specified unit
3: Temperature(%)	Temperature as a percentage (needs the option /MV which adds a built-in temperature sensor).
4: Arithmetic Out	

↓

Access the LOWER_DISPLAY_MODE parameter and select the data to be displayed on the lower row of the LCD.

1: Blank	
2: Total	Totalized flow rate
3: Temperature	Temperature as a percentage (needs the option /MV which adds a built-in temperature sensor).
4: Integrator Out	

↓

Access the DISPLAY_CYCLE parameter and set the display refresh cycle. The cycle can be set to a multiple of 500 milliseconds in a range from 1 to 10 (= 500 ms to 5 s), and is set to 1 (= 500 ms) by default. Prolong the cycle as necessary to improve legibility such as when used in a low temperature environment which makes the indications hard to read.

FA0211.ai

The UPPER_DISPLAY_MODE and LOWER_ DISPLAY_MODE parameter settings in the transducer (TR) block, and the L_TYPE settings in the AI1 and AI2 blocks determine which data items, and their values and units, are displayed on the LCD indicator, as shown in the following tables.

Display on Upper Row of LCD Indicator

UPPER_DISPLAY_MODE	Displayed Value, Display Unit, and Display Format		
FLOW RATE (%)	L_TYPE of AI1	= DIRECT	= INDIRECT
	Value	Percentage calculated from OUT. Value and XD_SCALE of AI1 (see note 1)	Percentage calculated from OUT.Value and OUT_SCALE of AI1 (see note 2)
	Unit	%	
	Format	Number, to one decimal place	
FLOW RATE	L_TYPE of AI1	= DIRECT	= INDIRECT
	Value	OUT.Value of AI1	OUT.Value of AI1 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	As specified by XD_SCALE.Units Index of AI1	As specified by OUT_SCALE.Units Index of AI1
	Format	Determined by the value of XD_SCALE.EU at 100 of AI1.	Determined by the value of OUT_SCALE.EU at 100 of AI1.
TEMPERATURE (%)	L_TYPE of AI2	= DIRECT	= INDIRECT
	Value	Percentage calculated from OUT. Value and XD_SCALE of AI2 (see note 1)	Percentage calculated from OUT.Value and OUT_SCALE of AI2 (see note 2)
	Unit	%	
	Format	Number, to one decimal place	
Arithmetic Out	Value	AR OUT.Value	
	Unit	AR OUT_RANGE. Units Index	
	Format	AR OUT_RANGE. Eu_100, Eu_0	

Note 1: If L_TYPE is set to DIRECT, the following equation applies to determine the displayed percentage:
Percentage = (OUT.Value – XD_SCALE.EU at 0) / (XD_SCALE.EU at 100 – XD_SCALE.EU at 0) × 100
Note 2: If L_TYPE is set to INDIRECT, the following equation applies to determine the displayed percentage:
Percentage = (OUT.Value – OUT_SCALE.EU at 0) / (OUT_SCALE.EU at 100 – OUT_SCALE.EU at 0) × 100

Display on Lower Row of LCD Indicator

UPPER_DISPLAY_MODE	Displayed Value, Display Unit, and Display Format		
BLANK	Value	Blank	
	Unit	Blank	
TOTAL	Value	TOTAL_VAL of AI1	
	Unit	TERTIARY_VALUE_UNIT of transducer block (note 3)	
	Format	Determined by TOTAL_RATE_VAL of AI1.	
TEMPERATURE	L_TYPE of AI2	= DIRECT	= INDIRECT
	Value	OUT.Value of AI2 (scaled based on XD_SCALE)	OUT.Value of AI2 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	XD_SCALE.Units Index of AI2	OUT_SCALE.Units Index of AI2 (but without indication of "%")
	Format	Number, to one decimal place	
Integrator Out	Value	IT OUT.Value	
	Unit	IT OUT_RANGE. Units Index	
	Format	IT OUT_RANGE. Eu_100, Eu_0	

Note 3: The unit displayed for the totalized flow rate (TOTAL) is the value of TERTIARY_VALUE_UNIT in the transducer block, which is determined by the value of XD_SCALE.Units Index in the AI1 block.
Note 4: AI3 block does not display because it is the function block for flow calculation in the AR block.

The following units can be displayed on the LCD: m^3/min, m^3/h, L/min, L/h, Nm^3/min, Nm^3/h, kg/min, kg/h, t/min, and t/h.

A2.5 Setting the DI Function Blocks

DI function blocks output limit switch signals received from the transducer block.
Two DI blocks (DI1 and DI2) in each digitalYEWFLO have independent parameters. Set up the parameters of each AI block you use, individually as necessary. The following shows the DI1 setting procedure as an example.

(1) Setting the channel

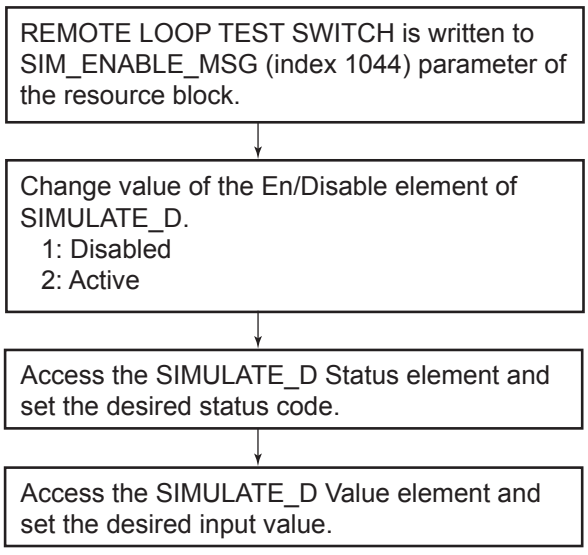
The CHANNEL parameter of the DI block, which specifies the switch number of the transducer's limit switch to be input to DI (DI1: 3, DI2: 4) for a digitalYEWFLO.

(2) Setting the damping time constant

Access the PV_FTIME parameter and set the damping time constant (in units of seconds).

(3) Simulation

Perform simulation of each AI function block by setting the desired value and status of the input to the block. Access the SIMULATE_D parameter and change the values of its elements as follows.



FA0212.ai

The DI block uses SIMULATE_D Status and SIMULATE_D Value in the SIMULATE_D parameter as its input status and value when simulation is active, or uses Transducer Status and Transducer Value in SIMULATE_D as its input status and value when simulation is disabled. Refer to Section 7.3 "Simulation Function."

APPENDIX 3. OPERATION OF EACH PARAMETER IN FAILURE MODE

*1: Standard Type and Multi-variable Type with THERMOMETER_FUNCTION in TR block Set to “Monitor Only” or “Not Use”
*2: Multi-variable Type with THERMOMETER_FUNCTION Used for Density Calculation

LCD Display	Alarm Detail	RS Block	TR Block	AI1 Block	AI2 Block	AI3 Block	Alarm Reset SW* (default)
AL-01	AMP. Module Failure 1 (AL-01)	—	<BLOCK_ERR> Other	<PV.Status> • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure			Not provided
			<XD_ERROR> AMP. Module Failure 1 (AL-01)				
			<PV.Status> Bad-Device Failure	<OUT.Status> • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure			
			<SV.Status> Bad-Device Failure				
AL-02	COM. Circuit Failure 1 (AL-02)	—	<BLOCK_ERR> Other	<PV.Status> • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure			Not provided
			<XD_ERROR> COM. Circuit Failure 1 (AL-02)				
			<PV.Status> Bad-Device Failure	<OUT.Status> • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure			
			<SV.Status> Bad-Device Failure				
AL-03	COM. Circuit Failure 2 (AL-03)	—	<BLOCK_ERR> Other	<PV.Status> • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure			Not provided
			<XD_ERROR> COM. Circuit Failure 2 (AL-03)				
			<PV.Status> Bad-Device Failure	<OUT.Status> • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure			
			<SV.Status> Bad-Device Failure				
AL-04	AMP. Module Failure 2 (AL-04)	<BLOCK_ERR> Lost Static Data Lost MV Data	<BLOCK_ERR> Other	<PV.Status> Bad-Non Specific			Not provided
			<XD_ERROR> AMP. Module Failure 2 (AL-04)				
			<PV.Status> Bad-Non Specific	<OUT.Status> Bad-Non Specific			
			<SV.Status> Bad-Non Specific				
AL-05	Flow Sensor Failure (AL-05)	—	<BLOCK_ERR> Other	<PV.Status> Uncertain-Non Specific		<PV.Status> Uncertain-Non Specific	Provided (ON)
			<XD_ERROR> Flow Sensor Failure (AL-05)				
			<PV.Status> Uncertain-Sensor Conversion not Accurate	<OUT.Status> Uncertain-Non Specific		<OUT.Status> Uncertain-Non Specific	

LCD Display	Alarm Detail	RS Block	TR Block	AI1 Block	AI2 Block	AI3 Block	Alarm Reset SW* (default)
AL-06	Input Circuit Failure (AL-06)		<BLOCK_ERR> Other	<PV.Status> *1 Uncertain-Non Specific *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure	<PV.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure	<PV.Status> Uncertain-Non Specific	Provided (ON)
			<XD_ERROR> Input Circuit Failure (AL-06)				
			<PV.Status> Uncertain Sensor Conversion not Accurate	<OUT.Status> *1 Uncertain-Non Specific *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure	<OUT.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward= Active Bad-Device Failure	<OUT.Status> Uncertain-Non Specific	
			<SV.Status> Bad-Device Failure				

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	Alarm Reset SW* (default)
AL-01	AMP. Module Failure 1 (AL-01)	<PV_D.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure <OUT_D.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure					Not provided
AL-02	COM. Circuit Failure 1 (AL-02)	<PV_D.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure <OUT_D.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure					Not provided
AL-03	COM. Circuit Failure 2 (AL-03)	<PV_D.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure <OUT_D.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure					Not provided
AL-04	AMP. Module Failure 2 (AL-04)	<PV_D.Status> Bad-Non Specific <OUT_D.Status> Bad-Non Specific					Not provided
AL-05	Flow Sensor Failure (AL-05)	<PV_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific <OUT_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					Provided (ON)

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	Alarm Reset SW* (default)
AL-06	Input Circuit Failure (AL-06)	<PV_D.Status> *1 • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific • TARGET in TB's LIMSW = SECONDARY_ VALUE • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward=Active Bad-Device Failure *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Activez Bad-Device Failure					Provided (ON)
		<OUT_D.Status> *1 • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific • TARGET in TB's LIMSW = SECONDARY_ VALUE • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure					

LCD Display	Alarm Detail	RS Block	TR Block	AI1 Block	AI2 Block	AI3 Block	Alarm Reset SW* (default)
AL-07	Temp. Converter Failure (AL-07)		<BLOCK_ERR> Other	<PV.Status> *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure	<PV.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure		Not provided
			<XD_ERROR> Temp. Converter Failure (AL-07)				
			<PV.Status> *2 Bad-Device Failure	<OUT.Status> *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure	<OUT.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Device Failure		
			<SV.Status> Bad-Device Failure				
AL-08	Temp. Sensor Failure (AL-08)		<BLOCK_ERR> Other	<PV.Status> *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Sensor Failure	<PV.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Sensor Failure		Not provided
			<XD_ERROR> Temp. Sensor Failure (AL-08)				
			<PV.Status> *2 Bad-Sensor Failure	<OUT.Status> *2 • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Sensor Failure	<OUT.Status> • Default Bad-Non Specific • STATUS_OPTS: Propagate Fault Forward = Active Bad-Sensor Failure		
			<SV.Status> Bad-Sensor Failure				
AL-20	No FB Scheduled (AL-20)						Not provided
AL-21	RB in O/S Mode (AL-21)		<PV.Status> Bad-Non Specific	<OUT.Status> Bad-Out of Service			Not provided
			<SV.Status> Bad-Non Specific				
AL-22	TB in O/S Mode (AL-22)		<BLOCK_ERR> Out of Service	<PV.Status> Bad-Non Specific			Not provided
			<PV.Status> Bad-Out of Service				
			<SV.Status> Bad-Out of Service	<OUT.Status> Bad-Non Specific			
AL-23	AI1 in O/S Mode (AL-23)			<BLOCK_ERR> Out of Service			Provided (ON)
				<OUT.Status> Bad-Out of Service			
AL-24	AI2 in O/S Mode (AL-24)				<BLOCK_ERR> Out of Service		Provided (OFF)
					<OUT.Status> Bad-Out of Service		
AL-25	DI1 in O/S Mode (AL-25)						Provided (OFF)
AL-26	DI2 in O/S Mode (AL-26)						Provided (OFF)

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	AlarmReset SW* (default)
AL-07	Temp. Converter Failure (AL-07)	<PV_D.Status> *1 • TARGET in TB's LIMSW = SECONDARY_VALUE • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure *2 • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure					Not provided
		<OUT_D.Status> *1 • TARGET in TB's LIMSW = SECONDARY_VALUE • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure *2 • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure					
AL-08	Temp. Sensor Failure (AL-08)	<PV_D.Status> *1 • TARGET in TB's LIMSW = SECONDARY_VALUE • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Sensor Failure *2 • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure					Not provided
		<OUT_D.Status> *1 • TARGET in TB's LIMSW = SECONDARY_VALUE • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Sensor Failure *2 • Default Bad-Non Specific • STATUS_OPTS:Propagate Fault Forward = Active Bad-Device Failure					
AL-20	No FB Scheduled (AL-20)						Not provided
AL-21	RB in O/S Mode (AL-21)	<OUT_D.Status> Bad-Out of Service		<OUT.Status> Bad-Out of Service	<OUT.Status> Bad-Out of Service	<OUT.Status> Bad-Out of Service	Not provided
AL-22	TB in O/S Mode (AL-22)	<PV_D.Status> Bad-Non Specific					Not provided
		<OUT_D.Status> Bad-Non Specific					

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	AlarmReset SW* (default)
AL-23	AI1 in O/S Mode (AL-23)						Provided (ON)
AL-24	AI2 in O/S Mode (AL-24)						Provided (OFF)
AL-25	DI1 in O/S Mode (AL-25)	<BLOCK_ERR> Out of Service <OUT_D.Status> (OFF) Bad-Out of Service					Provided (OFF)
AL-26	DI2 in O/S Mode (AL-26)		<BLOCK_ERR> Out of Service <OUT_D.Status> Bad-Out of Service				Provided (OFF)

LCD Display	Alarm Detail	RS Block	TR Block	AI1 Block	AI2 Block	AI3 Block	Alarm Reset SW* (default)
AL-27	PID in O/S Mode (AL-27)						Provided (OFF)
AL-28	AI3 in O/S Mode (AL-28)					<BLOCK_ERR> Out of Service <OUT.Status> Bad-Out of Service	Provided (OFF)
AL-29	IT in O/S Mode (AL-29)						Provided (OFF)
AL-30	AR in O/S Mode (AL-30)						Provided (OFF)
AL-41	Flow Rate Over Range (AL-41)		<BLOCK_ERR> Other <XD_ERROR> Flow Velocity Over Range (AL-41) <PV.Status> Uncertain-Sensor Conversion not Accurate	<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific		<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific	Not provided
AL-42	Flow Span Exceed Limit (AL-42)		<BLOCK_ERR> Other <XD_ERROR> Flow Span Exceed Limit (AL-42) <PV.Status> Uncertain -EngineeringUnit not Violation	<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific		<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific	Not provided
AL-43	Temp. Over Range (AL-43)		<BLOCK_ERR> Other <XD_ERROR> Temp. Over Range (AL-43) <PV.Status> *2 Uncertain-Non Specific <SV.Status> Uncertain-Substitude	<PV.Status> *2 Uncertain-Non Specific <OUT.Status> *2 Uncertain-Non Specific	<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific		Not provided
AL-51	Transient Vibration (AL-51)		<PV.Status> Uncertain-Last Usable Value	<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific		<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific	Provided (OFF)
AL-52	High Vibration (AL-52)		<PV.Status> Bad-Non Specific	<PV.Status> Bad-Non Specific <OUT.Status> Bad-Non Specific		<PV.Status> Bad-Non Specific <OUT.Status> Bad-Non Specific	Provided (OFF)
AL-53	Clogging (AL-53)		<PV.Status> Uncertain-Sensor Conversion not Accurate	<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific		<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific	Provided (OFF)
AL-54	Fluctuating (AL-54)		<PV.Status> Uncertain-Sensor Conversion not Accurate	<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific		<PV.Status> Uncertain-Non Specific <OUT.Status> Uncertain-Non Specific	Provided (OFF)
AL-61	Indicator Over Range (AL-61)						Not provided

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	Alarm Reset SW* (default)
AL-27	PID in O/S Mode (AL-27)			<BLOCK_ERR> Out of Service <OUT.Status> Bad-Out of Service			Provided (OFF)
AL-28	AI3 in O/S Mode (AL-28)						Provided (OFF)
AL-29	IT in O/S Mode (AL-29)				<BLOCK_ERR> Out of Service <OUT.Status> Bad -Out of Service		Provided (OFF)
AL-30	AR in O/S Mode (AL-30)					<BLOCK_ERR> Out of Service <OUT.Status> Bad-Out of Service	Provided (OFF)
AL-41	Flow Rate Over Range (AL-41)	<PV_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific <OUT_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					Not provided
AL-42	Flow Span Exceed Limit (AL-42)	<PV_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific <OUT_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					Not provided
AL-43	Temp. Over Range (AL-43)	<PV_D.Status> *1 • TARGET in TB's LIMSW = SECONDARY_VALUE Uncertain-Non Specific *2 Uncertain-Non Specific <OUT_D.Status> *1 • TARGET in TB's LIMSW = SECONDARY_VALUE Uncertain-Non Specific *2 Uncertain-Non Specific					Not provided
AL-51	Transient Vibration (AL-51)	<PV_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific <OUT_D.Status> (OFF) • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					Provided (OFF)
AL-52	High Vibration (AL-52)	<PV_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific <OUT_D.Status> (OFF) • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					Provided (OFF)

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	Alarm Reset SW* (default)
AL-53	Clogging (AL-53)	<PV_D.Status> • TARGET in TB's LIMSW = SECONDARY_VALUE Uncertain-Non Specific					Provided (OFF)
		<OUT_D.Status> (OFF) • TARGET in TB's LIMSW = SECONDARY_VALUE Uncertain-Non Specific					
AL-54	Fluctuating (AL-54)	<PV_D.Status> • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					Provided (OFF)
		<OUT_D.Status> (OFF) • TARGET in TB's LIMSW = PRIMARY_VALUE Uncertain-Non Specific					
AL-61	Indicator Over Range (AL-61)						Not provided

LCD Display	Alarm Detail	RS Block	TR Block	AI1 Block	AI2 Block	AI3 Block	Alarm Reset SW* (default)
AL-62	AI1 in Man Mode (AL-62)			<OUT.Status> • Default • STATUS_OPTS: Uncertain if Man mode = Active Uncertain-Non Specific			Provided (ON)
AL-63	AI1 Simulation Active (AL-63)	<BLOCK_ERR> Simulation Active		<BLOCK_ERR> Simulation Active			Provided (ON)
AL-64	AI1 Not Scheduled (AL-64)						Provided (ON)
AL-65	AI2 in Man Mode (AL-65)				<OUT.Status> • Default • STATUS_OPTS: Uncertain if Man mode =Active Uncertain-Non Specific		Provided (OFF)
AL-66	AI2 Simulation Active (AL-66)	<BLOCK_ERR> Simulation Active			<BLOCK_ERR> Simulation Active		Provided (OFF)
AL-67	AI2 Not Scheduled (AL-67)						Provided (OFF)
AL-68	DI1 in Man Mode (AL-68)						Provided (OFF)
AL-69	DI1 Simulation Active (AL-69)	<BLOCK_ERR> Simulation Active					Provided (OFF)
AL-70	DI1 Not Scheduled (AL-70)						Provided (OFF)
AL-71	DI2 in Man Mode (AL-71)						Provided (OFF)
AL-72	DI2 Simulation Active (AL-72)	<BLOCK_ERR> Simulation Active					Provided (OFF)
AL-73	DI2 Not Scheduled (AL-73)						Provided (OFF)
AL-74	PID in Bypass Mode (AL-74)						Provided (OFF)
AL-75	PID Error 1 (AL-75)						Provided (OFF)
AL-76	PID Error 2 (AL-76)						Provided (OFF)

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	Alarm Reset SW* (default)
AL-62	AI1 in Man Mode (AL-62)						Provided (ON)
AL-63	AI1 Simulation Active (AL-63)						Provided (ON)
AL-64	AI1 Not Scheduled (AL-64)						Provided (ON)
AL-65	AI2 in Man Mode (AL-65)						Provided (OFF)
AL-66	AI2 Simulation Active (AL-66)						Provided (OFF)
AL-67	AI2 Not Scheduled (AL-67)						Provided (OFF)
AL-68	DI1 Man Mode (AL-68)	<OUT.Status> • Default • STATUS_OPTS: Uncertain if Man mode = Active Uncertain-Non Specific					Provided (OFF)
AL-69	DI1 Simulation Active (AL-69)	<BLOCK_ERR> Simulation Active					Provided (OFF)
AL-70	DI1 Not Scheduled (AL-70)						Provided (OFF)
AL-71	DI2 Man Mode (AL-71)		<OUT.Status> • Default Good(NC)-Non Specific • STATUS_OPTS: Uncertain if Man mode = Active Uncertain-Non Specific				Provided (OFF)
AL-72	DI2 Simulation Active (AL-72)		<BLOCK_ERR> Simulation Active				Provided (OFF)
AL-73	DI2 Not Scheduled (AL-73)						Provided (OFF)
AL-74	PID in Bypass Mode (AL-74)						Provided (OFF)
AL-75	PID Error 1 (AL-75)						Provided (OFF)
AL-76	PID Error 2 (AL-76)						Provided (OFF)

LCD Display	Alarm Detail	RS Block	TR Block	AI1 Block	AI2 Block	AI3 Block	Alarm Reset SW* (default)
AL-77	AI3 in Man Mode (AL-77)					<OUT.Status> • Default • STATUS_OPTS: Uncertain if Man mode = Active Uncertain-Non Specific	Provided (OFF)
AL-78	AI3 Simulation Active (AL-78)	<BLOCK_ERR> Simulation Active				<BLOCK_ERR> Simulation Active	Provided (OFF)
AL-79	AI3 Not Scheduled (AL-79)						Provided (OFF)
AL-80	IT in Man Mode (AL-80)						Provided (OFF)
AL-81	IT Not Scheduled (AL-81)						Provided (OFF)
AL-82	IT Total Backup Err (AL-82)						Provided (OFF)
AL-83	IT Conf. Err (AL-83)						Provided (OFF)
AL-84	AR in Man Mode (AL-84)						Provided (OFF)
AL-85	AR Not Scheduled (AL-85)						Provided (OFF)
AL-86	AR Range Conf. Err (AL-86)						Provided (OFF)
AL-87	AR Temp. IN Over Range (AL-87)						Provided (OFF)
AL-88	AR Press IN Over Range (AL-88)						Provided (OFF)
AL-89	AR Flow IN Not Connected (AL-89)						Provided (OFF)
AL-90	AR Temp. IN Not Connected (AL-90)						Provided (OFF)
AL-91	AR Press IN Not Connected (AL-91)						Provided (OFF)
AL-92	AR Comp. Coef.Conf. Err (AL-92)						Provided (OFF)
AL-93	AR Output Unit Conf. Err (AL-93)						Provided (OFF)

LCD Display	Alarm Detail	DI1 Block	DI2 Block	PID Block	IT Block	AR Block	Alarm Reset SW* (default)
AL-77	AI3 in Man Mode (AL-77)						Provided (OFF)
AL-78	AI3 Simulation Active (AL-78)						Provided (OFF)
AL-79	AI3 Not Scheduled (AL-79)						Provided (OFF)
AL-80	IT in Man Mode (AL-80)				<OUT.Status> • Default Good(NC)-Non Specific • STATUS_OPTS: Uncertain if Man mode = Active Uncertain-Non Specific		Provided (OFF)
AL-81	IT Not Scheduled (AL-81)						Provided (OFF)
AL-82	IT Total Backup Err (AL-82)				<BLOCK_ERR> Lost NV Data <OUT.Status> (OFF) Bad-Device Failure		Provided (OFF)
AL-83	IT Conf. Err (AL-83)				<BLOCK_ERR> Configuration Error		Provided (OFF)
AL-84	AR in Man Mode (AL-84)					<OUT.Status> • Default Good(NC)-Non Specific • STATUS_OPTS: Uncertain if Man mode = Active Uncertain-Non Specific	Provided (OFF)
AL-85	AR Not Scheduled (AL-85)						Provided (OFF)
AL-86	AR Range Conf. Err (AL-86)					<BLOCK_ERR> Configuration Error	Provided (OFF)
AL-87	AR Temp. IN Over Range (AL-87)					<OUT.Status> Uncertain-Non Specific	Provided (OFF)
AL-88	AR Press IN Over Range (AL-88)					<OUT.Status> Uncertain-Non Specific	Provided (OFF)
AL-89	AR Flow IN Not Connected (AL-89)					<OUT.Status> Bad-Non Specific	Provided (OFF)
AL-90	AR Temp. IN Not Connected (AL-90)					<OUT.Status> Bad-Non Specific	Provided (OFF)
AL-91	AR Press IN Not Connected (AL-91)					<OUT.Status> Bad-Non Specific	Provided (OFF)
AL-92	AR Comp. Coef.Conf. Err (AL-92)					<BLOCK_ERR> Configuration Error <OUT.Status> Bad-Non Specific	Provided (OFF)
AL-93	AR Output Unit Conf. Err (AL-93)					<BLOCK_ERR> Configuration Error <OUT.Status> Bad-Configuration Error	Provided (OFF)

Alarm Reset Switch Settings

Some alarms can be disabled and enabled using switches in parameter ALARM_PERFORM inside the transducer block as explained below.

(1) Setting

As shown in the following table, the individual bits of ALARM_PERFORM at relative index 45 act as switches to disable and enable particular alarms. Write zeros to the respective bits to disable desired alarms, or write ones to enable them.

(2) Default Values

Bit in ALARM_PERFORM	Corresponding Alarms	Factory Default (0 = Disable; 1 = Enable)
Bit 15	AL-84 to AL-93 (alarms pertaining to AR)	0
Bit 14	AL-80 to AL-83 (alarms pertaining to IT)	0
Bit 13	AL-77 to AL-79 (alarms pertaining to AI3)	0
Bit 12	AL-62 to AL-64 (alarms pertaining to AI1)	1
Bit 11	AL-65 to AL-67 (alarms pertaining to AI2)	0
Bit 10	AL-68 to AL-70 (alarms pertaining to DI1)	0
Bit 9	AL-71 to AL-73 (alarms pertaining to DI2)	0
Bit 8	AL-74 to AL-76 (alarms pertaining to PID)	0
Bit 7	Not used.	
Bit 6	Corresponds to parameter K45 in a non-Fieldbus type digitalYEWFLO. Selects the output action upon occurrence of “High Vibration” in self-diagnostics.	1
Bit 5	AL-05 (flow sensor fault)	1
Bit 4	AL-06 (failure of amplifier’s input circuit)	1
Bit 3	AL-51 (transient excessive vibration [transient disturbance])	0
Bit 2	AL-52 (excessive vibration)	0
Bit 1	AL-53 (flow anomaly [clogging])	0
Bit 0	AL-54 (flow anomaly [excessive output fluctuations])	0

These default bit statuses comprise 0x1070 as the default value of ALARM_PERFORM.

APPENDIX 4. FUNCTION DIAGRAMS OF FUNCTION BLOCKS

A4.1 AI Function Block

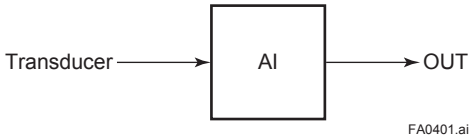


Figure A4.1 Input/Output of AI Block

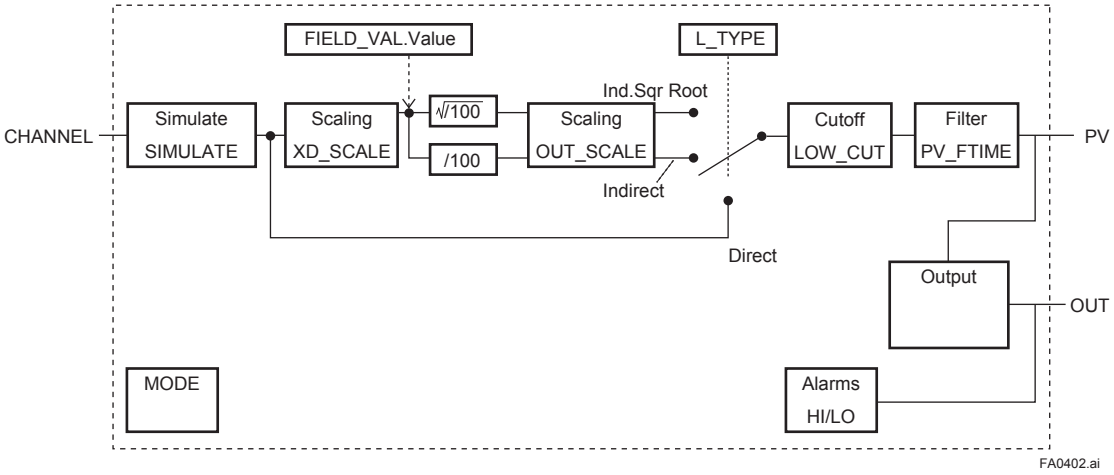


Figure A4.2 Function Diagram of AI Block

A4.2 DI Function Block

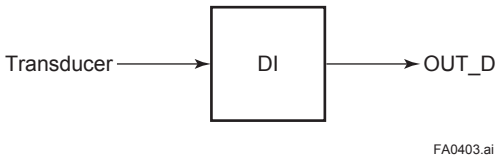


Figure A4.3 Input/Output of DI Block

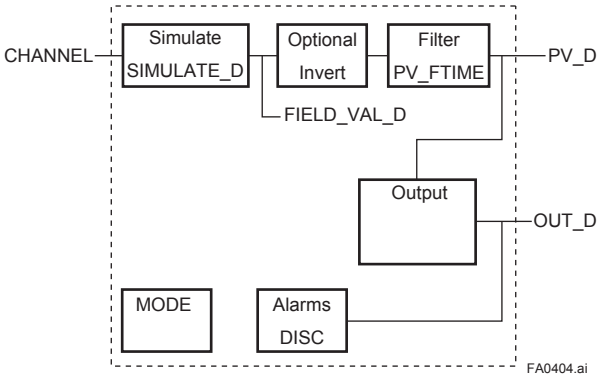


Figure A4.4 Function Diagram of DI Block

APPENDIX 5. INTEGRATOR (IT) BLOCK

The Integrator (IT) block adds two main inputs and integrates them for output. The block compares the integrated or accumulated value to TOTAL_SP and PRE_TRIP and generates discrete output signals OUT_TRIP or OUT_PTRIP when the limits are reached.
The output is as represented by the following equation (for counting upward and rate conversion).

OUT.Value = Integration start value + Total
Total = Total + Current Integral
Current Integral = $(x + y) \times \Delta t$
x: IN_1 value whose unit has been converted
y: IN_2 value whose unit has been converted
Δt: block execution period

A5.1 Schematic Diagram of Integrator Block

The following shows the schematic diagram of the Integrator block.

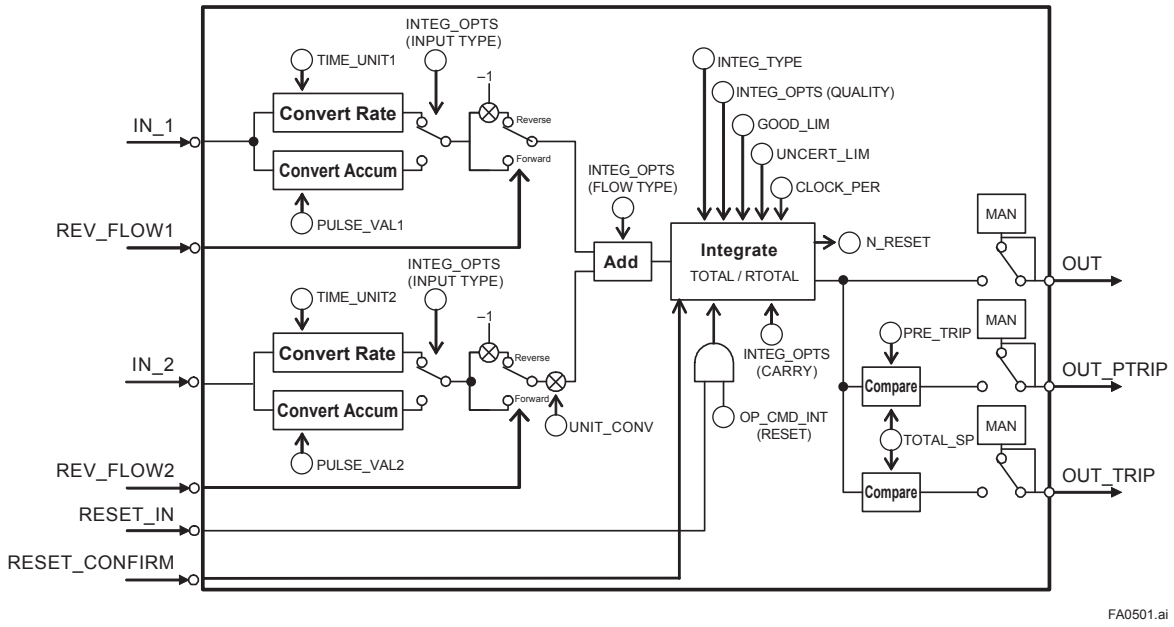


Figure A5.1 Integrator Block

IN_1: Block input 1 (value and status)
IN_2: Block input 2 (value and status)
REV_FLOW1: Indicates whether the sign of IN_1 is reversed. It is a discrete signal.
REV_FLOW2: Indicates whether the sign of IN_2 is reversed. It is a discrete signal.
RESET_IN: Resets the integrated values. It is a discrete signal.
RESET_CONFIRM: Reset confirmation input. It is a discrete signal.
OUT: Block output (value and status)
OUT_PTRIP: Set if the target value exceeds PRE_TRIP. It is a discrete signal.
OUT_TRIP: Set if the target value exceeds TOTAL_SP (or 0). It is a discrete signal.

The Integrator block is classified into the following five sections for each function:

- Input process section: Determines the input value status, converts the rate and accumulation, and determines the input flow direction.
- Adder: Adds the two inputs.
- Integrator: Integrates the result of the adder into the integrated value.
- Output process section: Determines the status and value of each output parameter.
- Reset process section: Resets the integrated values.

A5.2 Input Process Section

When executed, the Integrator block first performs input processing in the order of:
"Determining input status" → "Converting Rate or Accum" → "Determining the input flow direction"
Switching between Convert Rate and Convert Accum is made using bit 0 (for IN_1) or bit 1 (for IN_2) of INTEG_OPTS. INTEG_OPTS is one of the system parameters and should be set by the user. The values of IN_1 and IN_2 are not retained if the power is turned OFF.

A5.2.1 Determining Input Value Statuses

The following shows the correlation between the statuses of input parameters (IN_1, IN_2) and the statuses of input values used in the Integrator block.

Statuses of Input Parameters (IN_1, IN_2)	Bit 4 of INTEG_OPTS (Use Uncertain)	Bit 5* of INTEG_OPTS (Use Bad)	Status of Input Values Handled in IT Block
Good	Irrelevant	Irrelevant	Good
Bad	Irrelevant	H (=1)	Good
Bad	Irrelevant	L (=0)	Bad
Uncertain	H (=1)	Irrelevant	Good
Uncertain	L (=0)	Irrelevant	Bad

For addition (Refer to APPENDIX 5.3 "Adder"), if the status of an input value is "Bad," the "Good" value just before the status changed to "Bad" is used.

* Even if the Use Bad option is used, changing the internal status to "Good," the value of "Good" just before the status changed to "Bad" is used.

A5.2.2 Converting the Rate

The following describes an example of rate conversion.
In rate conversion, firstly convert the unit of two inputs to that based on seconds.

Next, convert the unit of the inputs to the same unit to be added together. The unit of IN_2 is standardized to that of IN_1. Then, calculates a weight, volume, or energy by multiplying each input value and block execution time. Because unit information is not input to the Integrator block as an input value, the user must input in advance tuned values to the TIME_UNIT1/2 and UNIT_CONV parameters.

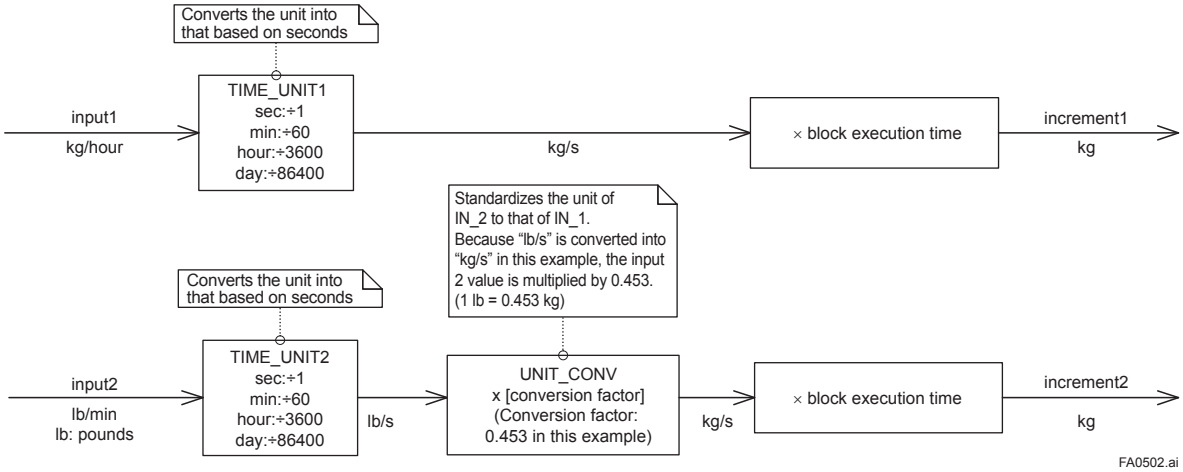


Figure A5.2 Increment Calculation with Rate Input

A5.2.3 Converting Accumulation

This following describes an example of accumulation conversion.
In accumulation conversion, the difference between the value executed previously and the value executed this time is integrated or accumulated.
This conversion applies when the output of a function block used as a counter is input to the input process of the Integrator block.
In order to convert the rate of change of an input to a value with an engineering unit, the user must configure the factor of conversion to the appropriate engineering unit in the PULSE_VAL1 and PULSE_VAL2 parameters.
Moreover, the unit of IN_2 is standardized to that of IN_1 in the same way as rate conversion. Thus, the user must also set an appropriate value to UNIT_CONV.

A5.2.4 Determining the Input Flow Direction

The Integrator block also considers the input flow direction. Information about the input flow direction is contained in REV_FLOW1 and REV_FLOW2 (0: FORWARD, 1: REVERSE).
In input processing, the sign of the value after rate and accumulation conversion is reversed if the REV_FLOW1 and REV_FLOW2 parameters are set to REVERSE. When determination of the flow direction of two input values is complete, these two inputs are passed to the adder. The settings in REV_FLOW will be retained even if the power is turned OFF.

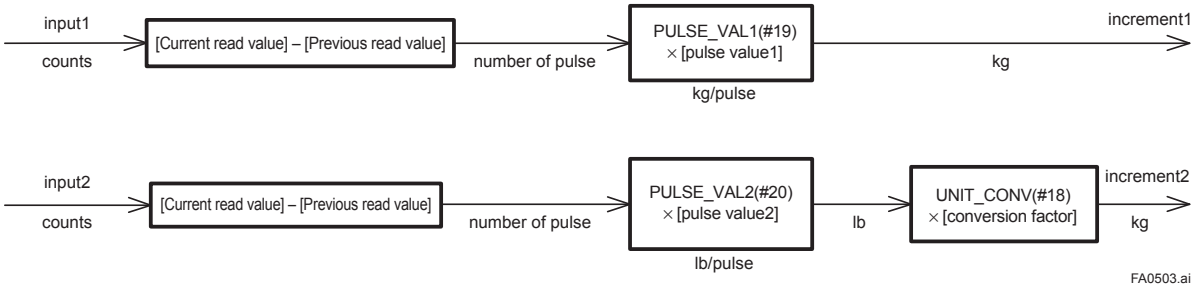


Figure A5.3 Increment Calculation with Counter Input

A5.3 Adder

When input processing is complete, two arguments that have been rate and accumulate converted will be passed to the adder. The adder adds these two values according to the option.

A5.3.1 Status of Value after Addition

If one of the statuses of two arguments is “Bad” or if two of them are both “Bad,” the status of the value after addition becomes “Bad.” In this case, the value of “Good” just before the status changed to “Bad” is used as the addition value.

When the statuses of two arguments are both “Good,” the status of the value after addition becomes "Good." In this case, the status of the value after addition will be used for the status applied to integration.

A5.3.2 Addition

The following three options are available for addition:

- TOTAL: Adds two argument values as is.
- FORWARD: Adds two argument values, regarding a negative value as “0.”
- REVERSE: Adds two argument values, regarding a positive value as “0.”

You can choose these options using bit 2 and bit 3 of INTEG_OPTS as follows:

Bit 2 of INTEG_OPTS (Flow Forward)	Bit 3 of INTEG_OPTS (Flow Reverse)	Adder Options
H	H	TOTAL
L	L	TOTAL
H	L	FORWARD
L	H	REVERSE

The result of the adder is passed to the integrator.
If only one of the inputs is connected, the value of a non-connected input will be ignored.
When bit 7 of INTEG_OPTS (Add zero if bad) has been set, if the status of a value after addition is “Bad,” the value after addition (increment) becomes “0.”

A5.4 Integrator

When addition is complete, its result will be passed to the integrator.
Integration consists of combinations of a reset method and counting up/down. There are the following seven integration types, which can be set using INTEG_TYPE.

1. UP_AUTO : Counts up with automatic reset when TOTAL_SP is reached
2. UP_DEM : Counts up from 0 and reset on demand.
3. DN_AUTO : Counts down with automatic reset when zero is reached
4. DN_DEM : Counts down from SP and reset on demand.
5. PERIODIC : Counts up from 0 and is reset periodically according to CLOCK_PER
6. DEMAND : Counts up from 0 and is reset on demand
7. PER&DEM : Counts up from 0 and is reset periodically or on demand

Each type of integration is independently run as a function.
There are the following four types of integrated values:

1. Total: Integrates the result of the adder as is.
2. ATotal: Integrates the absolute value of the result of the adder.
3. RTotal: Integrates the absolute value of the result of the adder only if the status of the result is "Bad."
   This value is used for the RTOTAL value.
4. AccTotal: An extension function. The result of the adder is integrated as is and will not be reset.

The value is used for the ACCUM_TOTAL (expanded parameter) value.
The Table A5.1 shows the details of INTEG_TYPE.

Table A5.1 INTEG_TYPE

Name	Integration Method	Integration Range	Reset Trigger (Reset if one of the following conditions is established)	Trip Output
UP_AUTO(1)	Counting up Starting from “0”	-INF< Total <TOTAL_SP 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• OUT reaches TOTAL_SP • RESET_IN = 1 • OP_CMD_INT = 1	○
UP_DEM(2)	Counting up Starting from “0”	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• RESET_IN = 1 • OP_CMD_INT = 1	○
DN_AUTO(3)	Counting down Starting from TOTAL_SP	0< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• OUT reaches “0” • RESET_IN = 1 • OP_CMD_INT = 1	○
DN_DEM(4)	Counting down Starting from TOTAL_SP	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• RESET_IN = 1 • OP_CMD_INT = 1	○
PERIODIC(5)	Counting up Starting from “0”	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• At the period specified by CLOCK_PER • OP_CMD_INT = 1	×
DEMAND(6)	Counting up Starting from “0”	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• RESET_IN = 1 • OP_CMD_INT = 1	×
PER&DEM(7)	Counting up Starting from “0”	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• At the period specified by CLOCK_PER • RESET_IN = 1 • OP_CMD_INT = 1	×

○: Trip output is made. ×: No trip output is made.

A5.5 Output Process

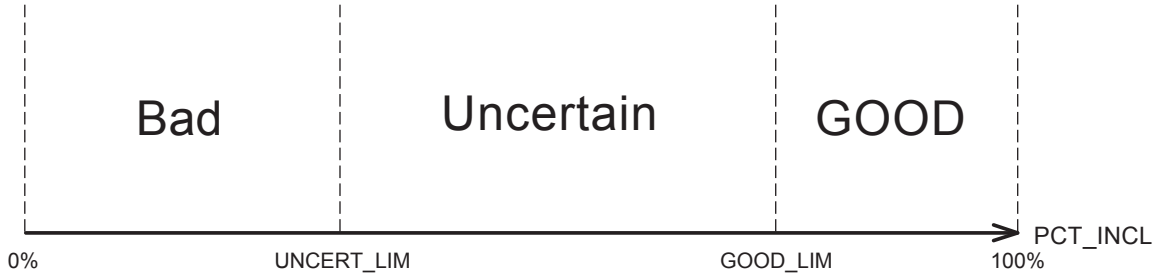
There are the following three output parameters:

1. OUT
2. OUT_TRIP
3. OUT_PTRIP

Parameters OUT_TRIP and OUT_PTRIP are used only when INTEG_TYPE is a value from 1 to 4.
In case of Integrator block related memory failed, the status of OUT, OUT_TRIP, OUT_PTRIP becomes “Bad-Device Failure”.

A5.5.1 Status Determination

The same criteria for determining the status of the output of the Integrator block are used in common for the above three parameters.



PCT_INCL=100×(1 - (msp of RTotal)/(msp of ATotal))

msp of RTotal: RTotal value that is converted into a short floating-point number
msp of ATotal: ATotal value that is converted into a short floating-point number
RTotal: Integrated value of the absolute values of the increments whose status is bad
ATotal: Integrated value of the absolute values of the increments regardless of the output status

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Figure A5.4 Status of OUT, OUT_TRIP, and OUT_PTRIP Outputs

OUT.Value, OUT_TRIP.Status, and OUT_PTRIP. Status are determined by the ratio of the “Good” integrated values to all integrated values, which is stored in PCT_INCL (0% to 100%). The user must set the threshold value of each status to UNCERT_LIM and GOOD_LIM.
The Integrator block determines the status of the output using the three parameters: PCT_INCL, UNCERT_LIM, and GOOD_LIM.

- PCT_INCL≥GOOD_LIM
  ⇒Good
- UNCERT_LIM≤PCT_INCL<GOOD_LIM
  ⇒Uncertain
- PCT_INCL<UNCERT_LIM
  ⇒Bad

If INTEG_TYPE is 5, 6, or 7, the status of the trip output becomes “Good-NS-Constant.”

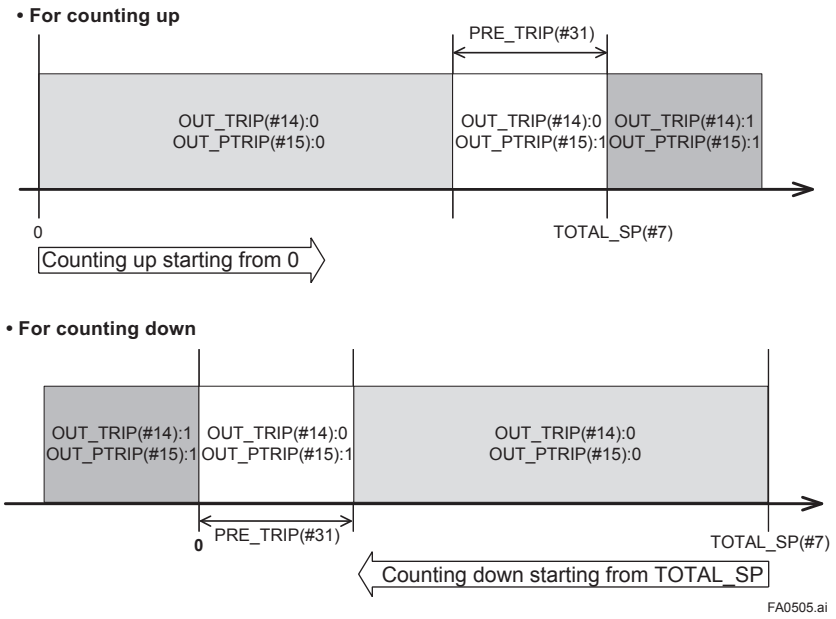
A5.5.2 Determining the Output Value

The value of OUT.Value is determined as follows:

- For counting up
  OUT = integration start value (0) + Total
- For counting down
  OUT = integration start value (TOTAL_SP) - Total

Total: Total of integrated values. This value is retained even if INTEG_TYPE is changed during integration (in AUTO).

If OUT is rewritten in the MAN mode, integration starts with the value rewritten in MAN mode after the mode was returned to AUTO.
The values in OUT_TRIP and OUT_PTRIP are determined according to the correlation between OUT and TOTAL_SP/PRE_TRIP.



For counting up, the OUT value is as follows:

- OUT < TOTAL_SP - PRE_TRIP
  ⇒OUT_TRIP = 0, COUT_PTRIP = 0
- TOTAL_SP - PRE_TRIP <= OUT < TOTAL_SP
  ⇒OUT_TRIP = 0, COUT_PTRIP = 1
- TOTAL_SP <= OUT
  ⇒OUT_TRIP = 1, COUT_PTRIP = 1

For counting down, the OUT value is as follows:

- PRE_TRIP < OUT
  ⇒OUT_TRIP = 0, COUT_PTRIP = 0
- 0 < OUT <= PRE_TRIP
  ⇒OUT_TRIP = 0, COUT_PTRIP = 1
- OUT <= 0
  ⇒OUT_TRIP = 1, COUT_PTRIP = 1

Note that the given conditions do not apply to the following cases:

- If INTEG_TYPE is 5, 6, or 7, OUT_TRIP and OUT_PTRIP always output “0.”
- If INTEG_TYPE is 1 or 3, occurrence of AutoRESET (reset caused if the threshold is exceeded) causes OUT_TRIP to hold “1” for five seconds.

A5.5.3 Mode Handling

Mode	Action	Output
Automatic (AUTO)	Normal action	Normal output
Manual (MAN)	Integration calculation is stopped. OUT will not be updated unless you set a value to it. No reset is accepted.	You may rewrite a value in OUT. If no value is rewritten, the value just before running in AUTO is held. When the mode returns to AUTO, integration starts with the written value or the value just before running in AUTO.
Out of Service (O/S)		

If you rewrite the value in OUT and RTOTAL while the mode is in MAN or O/S, N_RESET is incremented.

A5.6 Reset

A5.6.1 Reset Trigger

There are the following five types of reset triggers:
1. An integrated value exceeds TOTAL_SP.
2. An integrated value falls below “0.”
3. RESET_IN is “H.”
4. Every period specified in CLOCK_PER
5. OP_CMD_INT is 1.

The Table A5.2 shows the correlation between INTEG_TYPE and RESET triggers.

Table A5.2 RESET Triggers

	(1)	(2)	(3)	(4)	(5)
1:UP_AUTO	○	×	○	×	○
2:UP_DEM	×	×	○	×	○
3:DN_AUTO	×	○	○	×	○
4:DN_DEMO	×	×	○	×	○
5:PERIODIC	×	×	×	○	○
6:DEMAND	×	×	○	×	○
7:PER&DEM	×	×	○	○	○

○: Reset ×: No Reset

When OP_CMD_INT has become “H” and a reset was made, OP_CMD_INT automatically returns to “L.”
Even if RESET_IN becomes “H,” activating a reset, RESET_IN does not automatically return to “L.” The RESET_IN setting will not be retained if the power is turned OFF.

A5.6.2 Reset Timing

All items are reset during execution of the function block. Therefore, the minimum period of a reset is the block execution period.
● 5-second rule
If a reset is made, the next reset will not be accepted for 5 seconds after that.
Even if UP_AUTO (or DN_AUTO) is activated and TOTAL_SP (or 0) is reached within 5 seconds, the next reset will not be made for 5 seconds from the previous reset.
● CLOCK_PER
If INTEG_TYPE is PERIODIC (5) or PER&DEM (7), a reset is made at the period (sec) set to the CLOCK_PER parameter.
If the value in CLOCK_PER is smaller than the function block's execution period, bit 1 of BLOCK_ERR “Block Configuration Error” is set.

A5.6.3 Reset Process

The basic reset process sequence is as follows:
1. Snapshot
2. Clearing the integrated values
3. Reset count increment
4. Judging OUT_TRIP and OUT_PTRIP

1. Snapshot

Saves the following values in the specified parameters before clearing the integrated values. These values will be retained until the next reset is made.

STOTAL = Total
SRTOTAL = RTotal
SSP = TOTAL_SP

2. Clearing the integrated values

The reset process clears the Total, ATotal, and RTotal values in the internal registers.

Total = 0
ATotal = 0
RTotal = 0

3. Reset count increment

Each time a reset is made, the N_RESET parameter will be incremented.
The high limit is 999,999, and if this limit is exceeded, the count returns to “0.”

4. Judging OUT_TRIP and OUT_PTRIP

OUT_TRIP and OUT_PTRIP are judged again on the basis of the cleared integrated values. Refer to APPENDIX 5.5 “Output Process”
There are three options relating to a reset:

i Confirm reset (bit 8 of INTEG_OPTS)
ii Carry (bit 6 of INTEG_OPTS)
iii Generate reset event (bit 9 of INTEG_ OPTS)

i Confirm reset (bit 8 of INTEG_OPTS)
If this option is enabled, the next reset is rejected until “1” is set to RESET_CONFIRM.

ii Carry (bit 6 of INTEG_OPTS)
If this option is enabled while INTEG_TYPE is UP_AUTO or DN_AUTO, the value exceeding the threshold at a reset will be carried into the next integration.
If INTEG_TYPE is any setting other than UP_ AUTO or DN_AUTO, this option is irrelevant.

iii Generate reset event (bit 9 of INTEG_OPTS)
If this option is enabled, an alert event is generated if a reset occurs.

A5.7 List of Integrator Block Parameters

Index	Parameter Name	Initial Value	Write Mode	Definition
0	BLOCK_HEADER	TAG: “IT”	Block Tag =O/S	Information relating to this function block, such as block tag, DD revision, execution time
1	ST_REV	0	—	The revision level of the set parameters associated with the Integrator block
2	TAG_DESC	Spaces	AUTO	Stores comments describing tag information.
3	STRATEGY	1	AUTO	The strategy field is used by a high-level system to identify the function block.
4	ALERT_KEY	1	AUTO	Key information used to identify the location at which an alert occurred
5	MODE_BLK		AUTO	Integrator block mode. O/S, MAN, and AUTO are supported.
6	BLOCK_ERR	0	—	Indicates the active error conditions associated with the function block in bit strings.
7	TOTAL_SP	1000000.0	AUTO	The setpoint of an integrated value or a start value for counting down
8	OUT		MAN	The block output
9	OUT_RANGE	100000 0.0 m3(1034) 0		Set scaling for output display. This does not affect operation of the function block. It is used for making memos.
10	GRANT_DENY	0		The parameter for checking if various operations have been executed
11	STATUS_OPTS	0	O/S	Allows you to select a status-related option. The Integrator block uses “Uncertain if Man mode” only.
12	IN_1	0.0	AUTO	Inputs flow (Rate, Accum) signals from the AI block or PI block.
13	IN_2	0.0	AUTO	
14	OUT_TRIP	0	Value: AUTO	An output parameter informing the user that the integrated value has exceeded the setpoint
15	OUT_PTRIP	0	Value: AUTO	An output parameter informing the user that the integrated value is reaching the setpoint
16	TIME_UNIT1	sec(1)	MAN	Set the time unit of the Rate (kg/s, kg/min, kg/h ... etc.) of the corresponding IN.
17	TIME_UNIT2	sec(1)	MAN	
18	UNIT_CONV	1.0	AUTO	Specify the unit conversion factor for standardizing the unit of IN_2 into that of IN_1.
19	PULSE_VAL1	1.0	MAN	Set the factor for converting the number of pulses for the corresponding IN into an appropriate engineering unit.
20	PULSE_VAL2	1.0	MAN	
21	REV_FLOW1	0	AUTO	Selector switch used to specify the fluid flow direction (forward/reverse) with respect to the corresponding IN
22	REV_FLOW2	0	AUTO	
23	RESET_IN	0	AUTO	The parameter that receives a reset request from an external block to reset the integrated values
24	STOTAL	0.0	—	Indicates the snapshot of OUT just before a reset.
25	RTOTAL	0.0	MAN	Indicates the integrated value of the absolute values of the increments if the input status is “Bad.”
26	SRTOTAL	0.0	—	Indicates the snapshot of RTOTAL just before a reset.
27	SSP	0.0	—	Indicates the snapshot of TOTAL_SP just before a reset.
28	INTEG_TYPE	UP_AUTO (1)	AUTO	Integration Type Setting

Value	Name	Description
1	UP_AUTO	Counts up and is automatically reset when TOTAL_SP is reached.
2	UP_DEM	Counts up and is reset as demanded.
3	DN_AUTO	Counts down and is automatically reset when “0” is reached.
4	DN_DEM	Counts down and is reset as demanded.
5	PERIODIC	Counts up and is reset at periods specified in CLOCK_PER.
6	DEMAND	Counts up and is reset as demanded.
7	PER&DEM	Counts up and is reset periodically or as demanded.

<table>
<tr><th>Index</th><th>Parameter Name</th><th>Initial Value</th><th>Write Mode</th><th>Definition</th></tr>
<tr><td>29</td><td>INTEG_OPTS</td><td>0x0004</td><td>AUTO</td><td>Specifies an integration optional function.
<table>
<tr><th>bit</th><th>Option Name</th><th>Description</th></tr>
<tr><td>0</td><td>Input 1 accumulate</td><td>Selects Rate or Accum input of IN_1.</td></tr>
<tr><td>1</td><td>Input 2 accumulate</td><td>Selects Rate or Accum input of IN_2.</td></tr>
<tr><td>2</td><td>Flow forward</td><td>Integrates forward flow (interprets reverse flow as zero).*</td></tr>
<tr><td>3</td><td>Flow reverse</td><td>Integrates reverse flow (interprets forward flow as zero).*</td></tr>
<tr><td>4</td><td>Use uncertain</td><td>Uses an input value of IN_1 or IN_2 whose status is “Uncertain” regarding it as a value of “Good.”</td></tr>
<tr><td>5</td><td>Use bad</td><td>Uses an input value of IN_1 or IN_2 whose status is “Bad” regarding it as a value of “Good.”</td></tr>
<tr><td>6</td><td>Carry</td><td>Carries over an excess exceeding the threshold at reset to the next integration. (Note that this does not apply to UP_AUTO or DN_AUTO.)</td></tr>
<tr><td>7</td><td>Add zero if bad</td><td>Interprets an increment as zero if the status of the increment is “Bad.”</td></tr>
<tr><td>8</td><td>Confirm reset</td><td>After a reset, rejects the next reset until “Confirm” is set to RESET_CONFIRM.</td></tr>
<tr><td>9</td><td>Generate reset event</td><td>Generates an alert event at reset.</td></tr>
<tr><td>10~15</td><td>Reserved</td><td></td></tr>
</table>
* If both forward and reverse flows are enabled or disabled, both forward and reverse flows are integrated.</td></tr>
<tr><td>30</td><td>CLOCK_PER</td><td>86400.0[sec]</td><td>AUTO</td><td>Specify the period at which a periodic reset is made.</td></tr>
<tr><td>31</td><td>PRE_TRIP</td><td>100000.0</td><td>AUTO</td><td>Set an allowance applied before an integrated value exceeds the setpoint.</td></tr>
<tr><td>32</td><td>N_RESET</td><td>0.0</td><td>—</td><td>Indicates the number of resets in the range of 0 to 999999.</td></tr>
<tr><td>33</td><td>PCT_INCL</td><td>0.0[%]</td><td>—</td><td>The ratio of “the integrated values of the absolute values of the increments whose status is Good” to the “integrated values of the absolute values of the increments irrelevant to the status” (Equation)</td></tr>
<tr><td>34</td><td>GOOD_LIM</td><td>0.0[%]</td><td>AUTO</td><td>The threshold value of the ratio of “the integrated values of the increments whose status is Good” to all integrated values in which the status of OUT is “Good”</td></tr>
<tr><td>35</td><td>UNCERT_LIM</td><td>0.0[%]</td><td>AUTO</td><td>The threshold value of the ratio of “the integrated values of the increments whose status is Good” to all the integrated values in which the status of OUT is “Uncertain”</td></tr>
<tr><td>36</td><td>OP_CMD_INT</td><td>0</td><td>AUTO</td><td>Operator command that resets integrated values</td></tr>
<tr><td>37</td><td>OUTAGE_LIM</td><td>0.0</td><td>AUTO</td><td>Maximum time for which values can be retained in the event of power failure. It does not effect the block operation.</td></tr>
<tr><td>38</td><td>RESET_ CONFIRM</td><td>0</td><td>AUTO</td><td>Reset confirmation input, which is enabled when the Confirm reset option of INTEG_OPTS is chosen</td></tr>
<tr><td rowspan="5">39</td><td rowspan="5">UPDATE_EVT</td><td>1</td><td>AUTO</td><td rowspan="5">Indicates event information if an update event occurs.</td></tr>
<tr><td>1</td><td>—</td></tr>
<tr><td>0</td><td>—</td></tr>
<tr><td>0</td><td>—</td></tr>
<tr><td>0</td><td>—</td></tr>
<tr><td rowspan="5">40</td><td rowspan="5">BLOCK_ALM</td><td>1</td><td>AUTO</td><td rowspan="5">Indicates alarm information if a block alarm occurs.</td></tr>
<tr><td>1</td><td>—</td></tr>
<tr><td>0</td><td>—</td></tr>
<tr><td>0</td><td>—</td></tr>
<tr><td>0</td><td>—</td></tr>
<tr><td>41</td><td>ACCUM_TOTAL</td><td>0.0</td><td>—</td><td>Accumulated integrated values (no extension parameter is reset)</td></tr>
</table>

APPENDIX 6. Enhanced ARITHMETIC (AR) BLOCK

The Arithmetic (AR) block switches two main inputs of different measurement ranges seamlessly and combines the result with three auxiliary inputs through the selected compensation function (10 types) to calculate the output.
For the METHOD of AR block, refer to APPENDIX 10.2 “Enhanced AR Block.”

A6.1 Schematic Diagram of Arithmetic Block

The diagram below shows the Arithmetic block schematic.

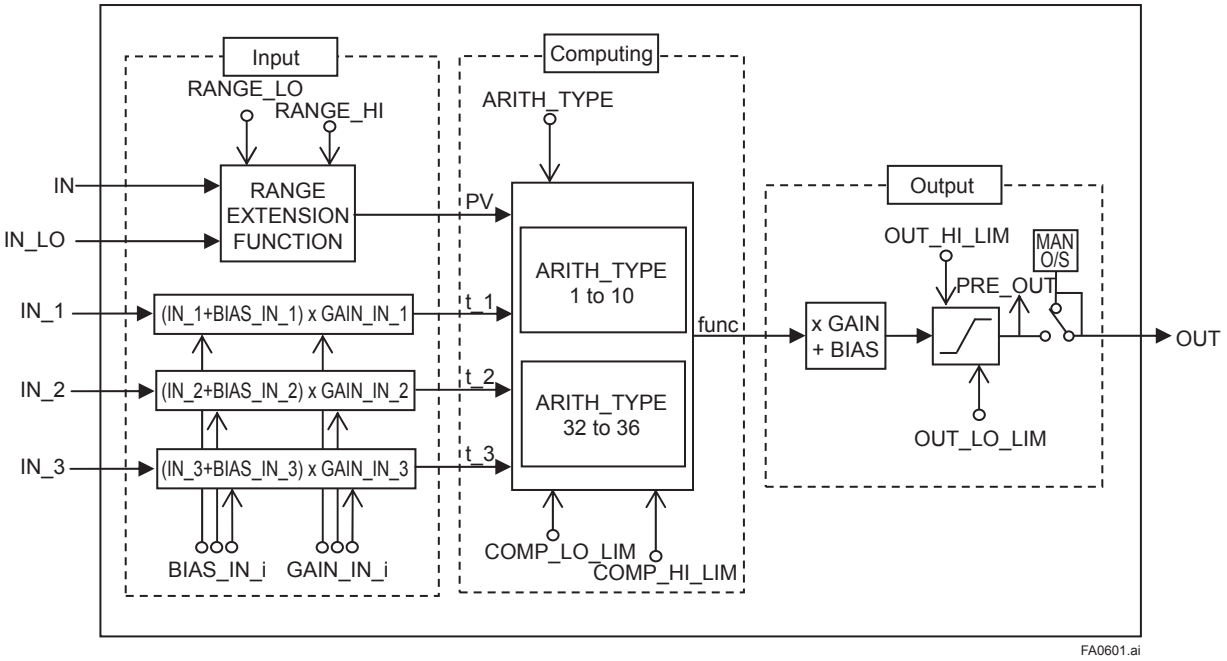


Figure A6.1 AR Block

The Arithmetic block is divided into three sections:

- Input section: Makes a go/no-go decision on the use of an input value, switches the range, and determines the PV status.
- Computation section: Makes calculations through ARITH_TYPE.
- Output section: Applies gain multiplication and bias addition to the calculated result to perform limitation processing for output.

* The range extension function compensates the IN and IN_LO input values when two devices with different ranges are connected, to make smooth input switching.

A6.2 Input Section

There are five inputs: IN and IN_LO main inputs and IN_1, IN_2, and IN_3 auxiliary inputs.
IN and IN_LO are intended to connect devices with different measurement ranges and allow the use of switching a measurement range by selecting the measuring device. However, because there are slight differences between IN and IN_LO values even when the same item is measured, instantaneous switching causes abrupt changes in the output.
To prevent this phenomenon, the Arithmetic block uses a function known as range extension to compensate the IN and IN_LO values between RANGE_HI and RANGE_LO. This enables the input to be switched smoothly. The result of the range extension function is substituted into PV to be used for calculations.

A6.2.1 Main Inputs

The range extension function determines the PV value in the following order:
1. If IN ≥ RANGE_HI → PV = IN
2. If IN ≤ RANGE_LO → PV = IN_LO
3. If RANGE_HI > IN > RANGE_LO → PV = g × IN + (1- g) × IN_LO

g = (IN - RANGE_LO) / (RANGE_HI - RANGE_LO)
RANGE_HI and RANGE_LO are threshold values for switching two main inputs seamlessly.

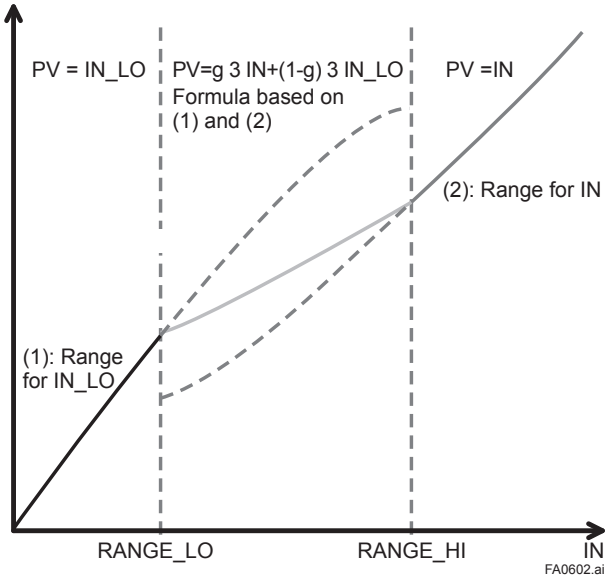


Figure A6.2 Range Extension Function and PV

PV is a parameter with status information, and PV status is determined by the value of "g."

If "g" < 0.5 → The status of IN_LO is used.

If "g" ≥ 0.5 → The status of IN is used.

Determination of the status is made with a hysteresis of 10% provided for 0.5.
If RANGE_LO > RANGE_HI, the statuses of PV and OUT are "Bad. Configuration Error." Then "Configuration Error" is output to BLOCK_ERR.
If there is only one main input, the input is incorporated into the computation section as is, not taking into account RANGE_HI and RANGE_LO.
Example:

Assuming that

RANGE_LO	20
RANGE_HI	300

the following are established:

IN = 310, IN_LO = 20 → PV = 310
IN = 230, IN_LO = 20 → g = (230 - 20) / (300 - 20) = 0.75
PV = 0.75 × 230 + (1 - 0.75) × 20 = 177.5
IN = 90, IN_LO = 20 → g = (90 - 20) / (300 - 20) = 0.25
PV = 0.25 × 230 + (1 + 0.25) × 20 = 37.5
IN = 19, IN_LO = 10 → PV = 10

A6.2.2 Auxiliary Inputs

There are bias and gain parameters for the IN_1, IN_2, and IN_3 auxiliary inputs. The following shows the equation using them.

$$t_i = (IN_i + BIAS_IN_i) \times GAIN_IN_i$$

The bias parameter is used for calculating absolute temperature or absolute pressure, while the gain parameter is used for normalization of square root extraction.

A6.2.3 INPUT_OPTS

INPUT_OPTS has an option that handles an input with “uncertain” or “bad” status as a “good” status input.

Bit	Function
0	Handles IN as a “good” status input if its status is “uncertain.”
1	Handles IN_LO as a “good” status input if its status is “uncertain.”
2	Handles IN_1 as a “good” status input if its status is “uncertain.”
3	Handles IN_1 as a “good” status input if its status is “bad.”
4	Handles IN_2 as a “good” status input if its status is “uncertain.”
5	Handles IN_2 as a “good” status input if its status is “bad.”
6	Handles IN_3 as a “good” status input if its status is “uncertain.”
7	Handles IN_3 as a “good” status input if its status is “bad.”
8 to 15	Reserved

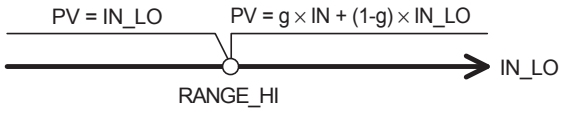
There are options called “IN Use uncertain” and “IN_LO Use uncertain” for the IN and IN_LO inputs. When these options are valid, IN and IN_LO are internally interpreted as “good” IN and IN_LO even if their statuses are “uncertain.” (There is no option for “bad” status.)
For the IN_1, IN_2, and IN_3 auxiliary inputs, there are options known as “IN_i Use uncertain” and “IN_i Use bad.” If these options are valid, an IN_i with “uncertain” or “bad” status is internally interpreted as a “good” IN_i.
* The exception is that if the input status is “Bad. Not Connected,” INPUT_OPTS does not apply and the input is considered “bad” as is.

A6.2.4 Relationship between the Main Inputs and PV

The value and PV status are determined by the statuses of two main inputs, INPUT_OPTS, and RANGE_LO and RANGE_HI.
· If the statuses of two main inputs are both “good” or anything other than “good”, refer to APPENDIX 6.2.1 “Main Inputs.”
· If only one of two main inputs has “good” status after application of INPUT_OPTS, the PV value is determined as follows:
  • If the status of IN is “good” and that of “IN_LO” is anything other than “good”
    IN > RANGE_LO → PV = IN
    IN ≤ RANGE_LO → Refer to APPENDIX 6.2.1 “Main Inputs.”
  • If the status of IN is anything other than “good” and that of “IN_LO” is “good”
    IN_LO < RANGE_HI → PV = IN_LO
    IN_LO ≥ RANGE_H → Refer to APPENDIX 6.2.1 “Main Inputs.”

If the status of IN is “good” and that of “IN_LO” is anything other than “good”

If the status of IN is anything other than “good” and that of “IN_LO” is “good”



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A6.3 Computation Section

A6.3.1 Computing Equations

This subsection shows computing equations used in the computation section:

1) Flow compensation (linear)
   func = PV × f
   f = (t_1 / t_2)
2) Flow compensation (square root)
   func = PV × f
   f = sqrt(t_1 / t_2 / t_3)
3) Flow compensation (approximate expression)
   func = PV × f
   f = sqrt(t_1 × t_2 × t_3 × t_3)
4) Quantity of heat calculation
   func = PV × f
   f = (t_1 - t_2)
5) Multiplication and division
   func = PV × f
   f = ((t_1 / t_2) + t_3)
6) Average calculation
   func = (PV + t_1 + t_2 + t_3) / N
   where N: number of inputs
7) Summation
   func = PV + t_1 + t_2 + t_3
8) Polynomial computation
   func = PV + t_1^2 + t_2^3 + t_3^4
9) HTG-level compensation
   func = (PV - t_1) / (PV - t_2)
10) Polynomial computation
   func = PV + GAIN_IN_1 × PV^2 + GAIN_IN_2 × PV^3 +GAIN_IN_3 × PV^4

* Precaution for computation

Division by “0”:	If a value is divided by “0,” the calculation result is interpreted as 10^{37} and, depending with core, a plus sign is added to it.
Negative square root:	The square root of an absolute value is extracted and a minus sign is added to it.

A6.3.2 Enhanced Computing Equations

32) Saturated steam (Temp): Saturated steam density calculation (by temperature: based on IAPWS-IF97)
   func = PV x Correction Value
   Correction Value: Saturated Steam density calculated from t_1 (temp input).
   Temperature range: 100 to 330°C

33) Saturated steam (Pressure): Saturated steam density calculation (by pressure based on IAPWS-IF97)
   func = PV x Correction Value.
   Correction Value: Saturated steam density calculated from t_2 (Press. input).
   Pressure range: 0.101417978 to 12.85752189 MPa

34) Superheat steam: Superheat steam density calculation (based on IAPWS-IF97)
   func = PV x Correction Value
   Correction Value: Superheat steam density calculated from t_1 (Temp. input) and t_2 (Press. input).
   Temperature range: 100 to 330°C
   Pressure range: 0.101417978 to 12.85752189 MPa

35) Gas temp pressure comp (Simple): Gas temperature and pressure compensation calculation. (Deviation factor: Fixed based on Boyle-Charle's law.)
   func = PV x Correction Value
   Correction Value: Gas density ratio (ρ_f /ρ_b) calculated from t_1 (Temp. input) and t_2 (Press. input), or, density at operating condition (ρ_f).

36) Liquid temp comp (Simple): Liquid temperature compensation calculation (based on API, JIS K 2249.)
   func = PV x Correction Value
   Correction Value: Liquid density at operating condition calculated from t_1 (Temp. input).

37) Gas temp pressure comp (Detail): Gas temperature and pressure compensation calculation (approximating polynomial calculation: 0 to 11).
   func = PV x Correction Value
   Correction Value: Gas density (Flow unit: Mass flow rate) at operating condition calculated from approximating polynomial calculation: 0 to 11, or Density ratio (Flow unit: Volumetric flow rate at normal condition) calculated from density at normal condition.

38) Liquid temp comp (Detail): Liquid temperature and pressure compensation calculation (approximating polynomial calculation).
   func = PV x Correction Value
   Correction Value: Liquid density at operating condition calculated from approximating polynomial calculation: 0 to 3.

A6.3.3 Compensated Values

In computing equations 1) to 5) in APPENDIX 6.3.1 “Computing Equations” and 32) to 38) in APPENDIX 6.3.2 “Enhanced Computing Equations”, the value “f” is restricted by the COMP_HI_LIM or COMP_LO_LIM parameter. In this case, the value “f” is treated as follows:

Calculation formura 1) to 5)
If f > COMP_HI_LIM:
f = COMP_HI_LIM

If f < COMP_LO_LIM:
f = COMP_LO_LIM

Calculation formura 32) to 38)
If Correction value > COMP_HI_LIM:
Correction value = COMP_HI_LIM
If Correction value < COMP_LO_LIM:
Correction value = COMP_LO_LIM

A6.3.4 Average Calculation

In computing equation 6) in APPENDIX 6.3.1 “Computing Equations”, the average of input value is calculated. Here, it is necessary to obtain the number of inputs, N. For this, determination is made to see if the sub-status of each input is “Not Connected.” Note that the main inputs may be accepted if IN or IN_LO is not in “Not Connected” sub-status. In this case, the number of inputs that are not in “Not Connected” sub-status is regarded as “N.”

A6.4 Output Section

After executing the computing equation, the block applies a gain to the calculated result and then adds a bias to it.
It then substitutes the result into PRE_OUT and if the mode is in AUTO, the value of PRE_OUT is taken as OUT.

PRE_OUT = func × gain + bias
where func: result of computing equation execution
OUT = PRE_OUT (when the mode is in AUTO)

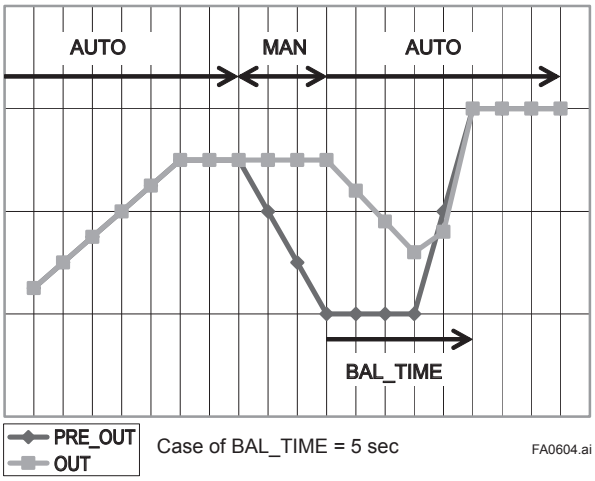
Next, the block performs limitation processing (OUT_HI_LIM, OUT_LOW_LIM). This processing is described as follows with respect to the value of PRE_OUT.

If PRE_OUT > OUT_HI_LIM:
PRE_OUT = OUT_HI_LIM
The “high limited” processing is applied to the status of PRE_OUT.
If PRE_OUT < OUT_LO_LIM:
PRE_OUT = OUT_LO_LIM
The “low limited” processing is applied to the status of PRE_OUT.

A6.4.1 Mode Handling

Mode	Output
Auto	OUT = PRE_OUT
MAN	For OUT, the OUT value in the Auto mode just before change to MAN or O/S is retained.
O/S	

In the Manual mode (including O/S), the value of OUT in the Auto mode just before a change to the Manual mode is held or the value written to OUT is output.
If the mode is switched from Manual to Auto, the value of OUT that is linearly changed with respect to the value of PRE_OUT for time set by BAL_TIME is output. The PRE_OUT always indicates the results of calculation. After elapse of BAL_TIME, OUT = PRE_OUT is established. Note that if the value of BAL_TIME is changed during linear change of the OUT value, it is not reflected. The value of BAL_TIME will be reflected only after the mode is changed the next time.



The value of OUT is represented by the following equation.

$$y_n = y_{n-1} + (x_n - y_{n-1}) / (\alpha - n)$$
$$\alpha = (T / t_c) + 1$$

*: The value of T/tc truncates digits to the right of the decimal point.

where y : OUT
x : PRE_OUT
t_c : period of execution
T : BAL_TIME
n : period

A6.4.2 Status Handling

The setting of INPUT_OPTS is applied to the input status. When INPUT_OPTS is applied, there are cases where the PV status becomes “good” even if the status of main inputs is “uncertain” or the status of auxiliary inputs is “uncertain” or “bad.”
The PV status is classified by the following:

- If the statuses of two main inputs are both “good” or anything other than “good”:
  Refer to APPENDIX 6.2.1 “Main Inputs”
- If only one of the statuses of two main inputs is “good”:
  - If the status of IN is “good” and that of “IN_LO” is anything other than “good”
    IN > RANGE_LO → The status of IN applies.
    IN ≤ RANGE_LO → Refer to APPENDIX 6.2.1 “Main Inputs”
  - If the status of IN is anything other than “good” and that of “IN_LO” is “good”
    IN_LO < RANGE_H → The status of IN_LO applies.
    IN_LO ≥ RANGE_HI → Refer to APPENDIX 6.2.1 “Main Inputs”

The exception is that if RANGE_LO > RANGE_HI, the PV status is made “Bad. Configuration Error.”
The input status irrelevant to the computing equation selected by ARITH_TYPE will be ignored and does not affect other statuses. The statuses of outputs (OUT.Status and PRE_OUT.Status) are interpreted as the status of the worst input among the statuses of PV and auxiliary inputs (IN_1, IN_2, and IN_3) to which INPUT_OPTS has been applied.
Example: If input status and INPUT_OPTS has been applied

		Case 1	Case 2	Case 3
PV		Good		
IN_1		Uncertain		
IN_2		Bad		
IN_3		Bad		
INPUT_OPTS	IN_1	Handled as a “good” input if its status is “uncertain.”	No option	
	IN_2	Handled as a “good” input if its status is “bad.”		No option
	IN_3	No option		
ARITH_TYPE		1) Flow compensation (linear) in APPENDIX 6.3.1 “Computing Equations”		
OUT.Status		Good	Uncertain	Bad

A6.5 List of the Arithmetic Block Parameters

<table>
<tr><th>Relative Index</th><th>Parameter</th><th>Write Mode</th><th>Initial Value</th><th>Description / Remarks</th></tr>
<tr><td>0</td><td>Block Header</td><td>Block Tag = O/S</td><td>TAG="AR"</td><td>Information relating to this function block, such as block tag, DD revision, and execution time</td></tr>
<tr><td>1</td><td>ST_REV</td><td>—</td><td>0</td><td>Indicates the revision level of the set parameters associated with the Arithmetic block. If a setting is modified, this revision is updated. It is used to check for parameter changes, etc.</td></tr>
<tr><td>2</td><td>TAG_DESC</td><td>AUTO</td><td>Null</td><td>A universal parameter that stores comments describing tag information</td></tr>
<tr><td>3</td><td>STRATEGY</td><td>AUTO</td><td>1</td><td>A universal parameter intended for use by a high-level system to identify function blocks</td></tr>
<tr><td>4</td><td>ALERT_KEY</td><td>AUTO</td><td>1</td><td>Key information used to identify the location at which an alert has occurred. Generally, this parameter is used by a high-level system to identify specific areas in a plant that are under the control of specific operators, to separate necessary alerts only. This is one of the universal parameters.</td></tr>
<tr><td>5</td><td>MODE_BLK</td><td></td><td>AUTO</td><td>A universal parameter representing the operation status of the Arithmetic block. It consists of the Actual, Target, Permit, and Normal modes.</td></tr>
<tr><td>6</td><td>BLOCK_ERR</td><td>—</td><td>0</td><td>Indicates the error status relating to the Arithmetic block.
The bit used by this function block is as follows:
Bit 1: Block Configuration Error
Bit 15: O/S mode</td></tr>
<tr><td>7</td><td>PV</td><td>—</td><td>0</td><td>The result of a range extension function is substituted into this.
When viewed from the computing equation, PV is the main input.</td></tr>
<tr><td>8</td><td>OUT</td><td>MAN</td><td>0</td><td>Block output</td></tr>
<tr><td>9</td><td>PRE_OUT</td><td>—</td><td>0</td><td rowspan="3">Always indicates the calculation result. The value is substituted into OUT in Auto mode. Indicates PV scaling (for making a memo).
Output scaling for the host (for making a memo)</td></tr>
<tr><td>10</td><td>PV_SCALE</td><td>O/S</td><td></td></tr>
<tr><td>11</td><td>OUT_RANGE</td><td>AUTO</td><td></td></tr>
<tr><td>12</td><td>GRANT_DENY</td><td>AUTO</td><td>0</td><td>The parameter used to check if various operations have been executed. The bits in the GRANT parameter corresponding to various operations are set before any of them are executed. After the operations are complete, the DENY parameter is checked to find out if any bit corresponding to the relevant operation has been set. If no bit has been set, it is evident that the operations have been executed successfully.</td></tr>
<tr><td>13</td><td>INPUT_OPTS</td><td>AUTO</td><td>0</td><td>Determines whether an input is used as a "good" input when the input status is "bad" or "uncertain."
<table>
<tr><th>Bit</th><th>Function</th></tr>
<tr><td>0</td><td>Handles IN as "good" input if its status is "uncertain."</td></tr>
<tr><td>1</td><td>Handles IN_LO as "good" input if its status is "uncertain."</td></tr>
<tr><td>2</td><td>Handles IN_1 as "good" input if its status is "uncertain."</td></tr>
<tr><td>3</td><td>Handles IN_1 as "good" input if its status is "bad."</td></tr>
<tr><td>4</td><td>Handles IN_2 as "good" input if its status is "uncertain."</td></tr>
<tr><td>5</td><td>Handles IN_2 as "good" input if its status is "bad."</td></tr>
<tr><td>6</td><td>Handles IN_3 as "good" input if its status is "uncertain."</td></tr>
<tr><td>7</td><td>Handles IN_3 as "good" input if its status is "bad."</td></tr>
<tr><td>8 to 15</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td>14</td><td>IN</td><td>AUTO</td><td>0</td><td>Input block</td></tr>
<tr><td>15</td><td>IN_LO</td><td>AUTO</td><td>0</td><td>Input for a low-range transmitter.
This is used for the range extension function.</td></tr>
<tr><td>16</td><td>IN_1</td><td>AUTO</td><td>0</td><td>Auxiliary input 1</td></tr>
<tr><td>17</td><td>IN_2</td><td>AUTO</td><td>0</td><td>Auxiliary input 2</td></tr>
<tr><td>18</td><td>IN_3</td><td>AUTO</td><td>0</td><td>Auxiliary input 3</td></tr>
<tr><td>19</td><td>RANGE_HI</td><td>AUTO</td><td>0</td><td>High limit for switching to a high-range transmitter by the range extension function.</td></tr>
<tr><td>20</td><td>RANGE_LO</td><td>AUTO</td><td>0</td><td>Low limit for switching to a low-range transmitter by the range extension function.</td></tr>
<tr><td>21</td><td>BIAS_IN_1</td><td>AUTO</td><td>0</td><td>IN_1 bias</td></tr>
<tr><td>22</td><td>GAIN_IN_1</td><td>AUTO</td><td>0</td><td>IN_1 gain</td></tr>
<tr><td>23</td><td>BIAS_IN_2</td><td>AUTO</td><td>0</td><td>IN_2 bias</td></tr>
<tr><td>24</td><td>GAIN_IN_2</td><td>AUTO</td><td>0</td><td>IN_2 gain</td></tr>
<tr><td>25</td><td>BIAS_IN_3</td><td>AUTO</td><td>0</td><td>IN_3 bias</td></tr>
<tr><td>26</td><td>GAIN_IN_3</td><td>AUTO</td><td>0</td><td>IN_3 gain</td></tr>
<tr><td>27</td><td>COMP_HI_LIM</td><td>AUTO</td><td>+INF</td><td>High limit of compensation factor f</td></tr>
<tr><td>28</td><td>COMP_LO_LIM</td><td>AUTO</td><td>-INF</td><td>Low limit of compensation factor f</td></tr>
</table>

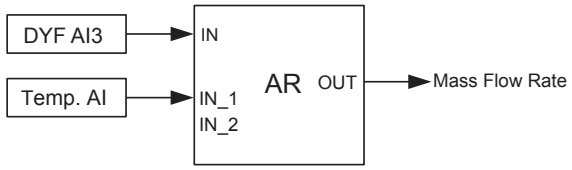
<table>
<tr><th>Relative Index</th><th>Parameter</th><th>Write Mode</th><th>Initial Value</th><th>Description / Remarks</th></tr>
<tr><td>29</td><td>ARITH_TYPE</td><td>AUTO</td><td>0x01</td><td>Computation algorithm identification no.
<table>
<tr><th>Value</th><th>Selection Name</th><th>Description</th></tr>
<tr><td>1</td><td>Flow compensation, linear</td><td>Flow compensation (linear)</td></tr>
<tr><td>2</td><td>Flow compensation, square root</td><td>Flow compensation (square root)</td></tr>
<tr><td>3</td><td>Flow compensation, approximate</td><td>Flow compensation (approximate expression)</td></tr>
<tr><td>4</td><td>BTU flow (*)</td><td>Quantity of heat calculation</td></tr>
<tr><td>5</td><td>Traditional Multiply Divide</td><td>Multiplication and division</td></tr>
<tr><td>6</td><td>Average</td><td>Average calculation</td></tr>
<tr><td>7</td><td>Traditional summer</td><td>Summation</td></tr>
<tr><td>8</td><td>Fourth order Polynomial, (Type 1)</td><td>4th-order (auxiliary input) polynomial computation</td></tr>
<tr><td>9</td><td>HTG level compensation (*)</td><td>HTG-level compensation</td></tr>
<tr><td>10</td><td>Fourth order Polynomial, (Type 2)</td><td>4th-order (main input) polynomial computation</td></tr>
<tr><td>11 to 31</td><td>Reserve</td><td>For reserve of FF Std calculation.</td></tr>
<tr><td>32</td><td>Saturated steam (Temperature)</td><td>Density calculation of Sat.Steam (Temp.)</td></tr>
<tr><td>33</td><td>Saturated steam (Pressure)</td><td>Density calculation of Sat.Steam (Press.)</td></tr>
<tr><td>34</td><td>Superheat steam</td><td>Gas Temp./Press. compensation calculation (Deviation factor: Fixed).</td></tr>
<tr><td>35</td><td>Gas temperature pressure compensation</td><td>Density calculation of S.H.Steam</td></tr>
<tr><td>36</td><td>Liquid temperature compensation</td><td>Liquid Temp. compensation Calculation</td></tr>
<tr><td>37</td><td>Gas temperature pressure compensation (Detail)</td><td>Gas Temp./Press. compensation calculation (approximating polynomial calculation: 0 to 11).</td></tr>
<tr><td>38</td><td>Liquid temperature compensation (Detail)</td><td>Liquid Temp./Press. compensation calculation (approximating polynomial calculation: 0 to 3).</td></tr>
</table>
* BTU stands for British thermal unit.
HTG stands for hydrostatic tank gauging.</td></tr>
<tr><td>30</td><td>BAL_TIME</td><td>AUTO</td><td>0</td><td>Time taken to return to the set value</td></tr>
<tr><td>31</td><td>BIAS</td><td>AUTO</td><td>0</td><td>Bias value used to calculate the output</td></tr>
<tr><td>32</td><td>GAIN</td><td>AUTO</td><td>1</td><td>Gain value used to calculate the output</td></tr>
<tr><td>33</td><td>OUT_HI_LIM</td><td>AUTO</td><td>+INF</td><td>Maximum output value</td></tr>
<tr><td>34</td><td>OUT_LO_LIM</td><td>AUTO</td><td>-INF</td><td>Minimum output value</td></tr>
<tr><td>35</td><td>UPDATE_EVT</td><td>—</td><td></td><td>Indicates event information if an update event (setting change) occurs.</td></tr>
<tr><td>36</td><td>BLOCK_ALM</td><td>—</td><td></td><td>Indicates alarm information if a block alarm occurs.</td></tr>
<tr><td>37</td><td>AR_ VOLUMETRIC_ FLOW_UNIT</td><td>O/S</td><td>m^3/h (1349)</td><td>Volumetric flow unit</td></tr>
<tr><td>38</td><td>AR_ TEMPERATURE_ UNIT</td><td>O/S</td><td>°C (1001)</td><td>Temperature unit</td></tr>
<tr><td>39</td><td>AR_BASE_ TEMPERATURE</td><td>MAN</td><td>0.0</td><td>Temperature unit at normal condition</td></tr>
<tr><td>40</td><td>AR_ PRESSURE_ UNIT</td><td>O/S</td><td>MPa (1132)</td><td>Pressure unit</td></tr>
<tr><td>41</td><td>AR_BASE_ PRESSURE_ABS</td><td>MAN</td><td>0.1013</td><td>Pressure unit at normal condition (abs)</td></tr>
<tr><td>42</td><td>AR_DEVIATION</td><td>MAN</td><td>1.0</td><td>Deviation factor</td></tr>
<tr><td>43</td><td>AR_DENSITY_ UNIT</td><td>O/S</td><td>kg/m^3 (1097)</td><td>Density unit</td></tr>
<tr><td>44</td><td>AR_BASE_ DENSITY</td><td>MAN</td><td>1.0</td><td>Density unit at normal condition</td></tr>
<tr><td>45</td><td>AR_FIRST_ TEMP_COEF</td><td>MAN</td><td>0.0</td><td>1st temperature coefficient for liquid</td></tr>
<tr><td>46</td><td>AR_SECOND_ TEMP_COEF</td><td>MAN</td><td>0.0</td><td>2nd temperature coefficient for liquid</td></tr>
<tr><td>47</td><td>AR_FLOW_ CONFIG</td><td>MAN</td><td>all 0.0</td><td>A polynomial coefficient for density calculation (16)
Gas Temp./Press. Calculation (Detail): use FLOW_CONFIG[0] to [11]
Liquid calculation (Detail): use FLOW_CONFIG [0] to [3]</td></tr>
<tr><td>48</td><td>AR_DENSITY_ FACTOR</td><td>—</td><td>—</td><td>Correction value:
Mass flow output: density at operating condition
Volumetric flow output: ratio of density at operation condition to density at normal condition.)</td></tr>
<tr><td>49</td><td>AR_DENSITY_ FACTOR_UNIT</td><td>—</td><td></td><td>Correction value unit. (The unit is indicated only for density at operation condition.)</td></tr>
</table>

Relative Index	Parameter	Write Mode	Initial Value	Description / Remarks
50	AR_CONFIG_SOFT_REV	AUTO	(Space)	Memo; The version of MV tool which is calculated multinominal approximation coefficient.
51	AR_CONFIG_DATE	AUTO	(Space)	Memo; The date of multinomial approximation coefficient setting.
52	AR_CONFIG_WHO	AUTO	(Space)	Memo; The person who set the multinominal approximation coefficient.
53	AR_CONFIG_STATUS	AUTO	0	Memo; Setting download status.
54	AR_CONFIG_VSTRING32	AUTO	(Space)	Memo; 32 characters
55	AR_CONFIG_VSTRING16	AUTO	(Space)	Memo; 16x2 characters
56	AR_CONFIG_OSTRING32	AUTO	0	Memo; 32 characters
57	AR_CONFIG_OSTRING2	AUTO	0	SUM of coefficient which is calculated at multinominal approximation coefficient setting.

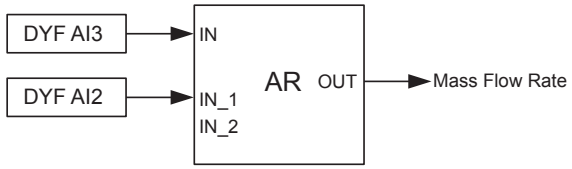
A6.6 Example of Connection

ARITH_TYPE:32 Saturated steam (Temperature)

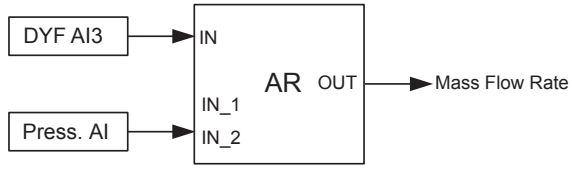
In case of using external temperature output



In case of using built-in temperature sensor output

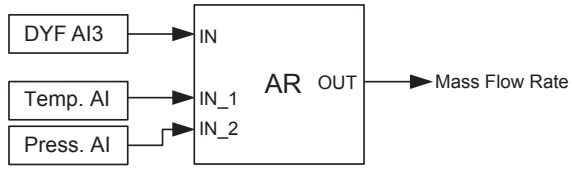


ARITH_TYPE:33 Saturated steam (Pressure)

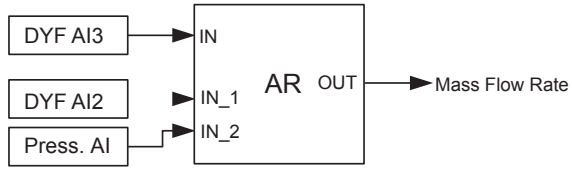


ARITH_TYPE:34 Superheat steam

In case of using external temperature output

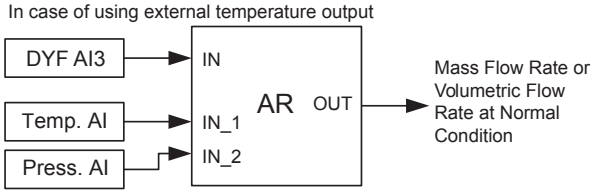


In case of using built-in temperature sensor output

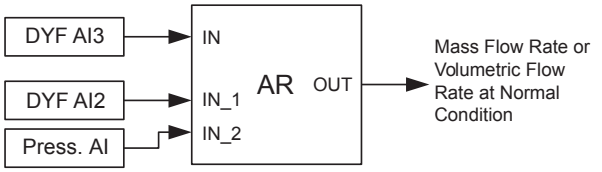


ARITH_TYPE:35 Gas temperature pressure compensation
ARITH_TYPE:37 Gas temperature pressure compensation (Detail)

In case of using external temperature output

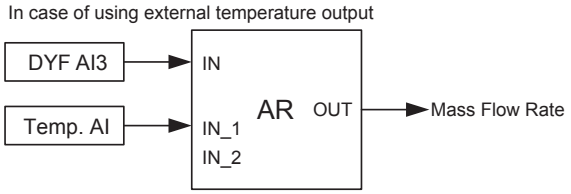


In case of using built-in temperature sensor output

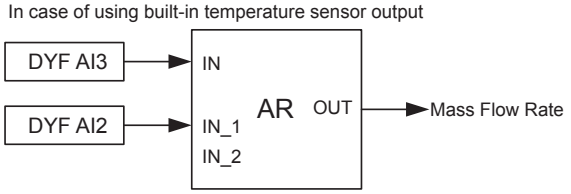


ARITH_TYPE:36 Liquid temperature compensation
ARITH_TYPE:38 Liquid temperature compensation (Detail)

In case of using external temperature output



In case of using built-in temperature sensor output



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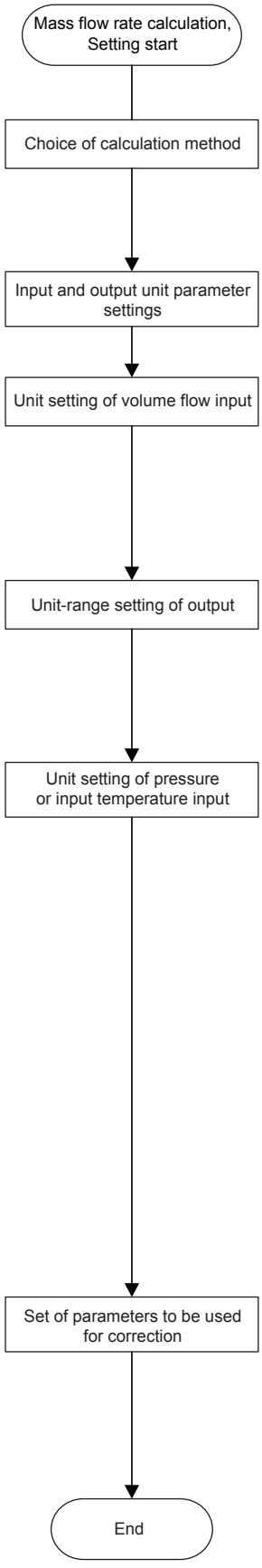
A6.7 Setting Procedure of the Mass Flow Rate Calculation



Choose from the following ARITH_TYPE.
32 : Saturated steam (Temperature) (Saturated steam density calculation (Temperature))
33 : Saturated steam (Pressure) (Saturated steam density calculation (Temperature))
34 : Superheat steam (Superheat steam density calculation)
35 : Gas temperature pressure compensation (Gas temperature and pressure correction operation)
36 : Liquid temperature compensation (Liquid temperature correction calculation)

Set the input of the following, the parameters of the output section.
GAIN = 1.0
If you are using a temperature input, GAIN_IN_1 = 1.0
If you use a pressure input, GAIN_IN_2 = 1.0compensation (liquid temperature correction calculation)

Set to AR_VOLUME_FLOW_UNIT the volume flow input unit.
Selectable units ;

AR_VOLUMETRIC_FLOW_UNIT
m^3/s (1347), m^3/min (1348), m^3/h (1349), m^3/d (1350), L/s (1351), L/min (1352), L/h (1353), L/d (1354), CFS (1356), CFM (1357), CFH (1358), ft^3/d (1359), gal/s (1362), GPM (1363), gal/h (1364), gal/d (1365), ImpGal/s (1367), ImpGal/min (1368), ImpGal/h (1369), ImpGal/d (1370), bbl/s (1371), bbl/min (1372), bbl/h (1373), bbl/d (1374)

Set to OUT_RANGE.Units Index units of output.
Selectable units,
Mass flow rate units: kg/s, kg/min, kg/h, t/s, t/min, t/h
Volumetric flow rate units: Nm^3/s, Nm^3/min, Nm^3/h, NL/s, NL/min, NL/h
If the gas pressure temperature correction calculation, units of all of the above can be set.
Otherwise, it can only be set in mass flow units.

Also, set the output range (100%, 0%) the EU_100, to EU_0.

If you are using a temperature input, set the AR_TEMP_UNIT the temperature unit.
Selectable units ;

AR_TEMPERATURE_UNIT
K (1000), °C (1001), °F (1002)

If you use a pressure input, set the AR_PRESSURE_UNIT the pressure unit.
Selectable units ;

AR_PRESSURE_UNIT
Pa (1130), Gpa (1131), Mpa (1132), kPa (1133), mpa (1134), µpa (1135), hPa (1136), bar (1137), mbar (1138), torr (1139), atm (1140), psi (1141), g/cm^2 (1144), kg/cm^2 (1145), inH_2O (1146), inH_2O (4°C) (1147), inH_2O (68°F) (1148), mmH_2O (1149), mmH_2O (4°C) (1150), mmH_2O (68°F) (1151), ftH_2O (1152), ftH_2O (4°C) (1153), ftH_2O (68°F) (1154), inHg (1155), inHg (0°C) (1156), mmHg (1157), mmHg (0°C) (1158),

AR_DENSITY_UNIT
kg/m^3 (1097), lb/ft^3 (1107), lb/gal (1108), lb/ImpGal (1430)

AR_DENSITY_FACTOR_UNIT
kg/m^3 (1097), lb/ft^3 (1107), lb/gal (1108), lb/ImpGal (1430), No units (1588)

(Pressure unit does not distinguish gauge pressure, absolute pressure.)
Also, if the input is a pressure gauge pressure, set the value of atmospheric pressure in BIAS_IN_2.

If you want to steam saturation density operation (temperature or pressure), the superheated steam density computation is set density units (AR_DENSITY_UNIT).

If you are the gas temperature and pressure correction computation is set standard state temperature AR_BASE_TEMP, standard state pressure AR_BASE_PRESSURE, the coefficient of variation AR_DEVIATION. For a mass flow unit, standard density of states and density AR_BASE_DENSITY unit AR_DENSITY_UNIT also please set the output unit.

If the solution is temperature correction calculation, set the standard density of states and density AR_BASE_DENSITY unit AR_DENSITY_UNIT, standard state temperature AR_BASE_TEMP, primary, secondary temperature correction factor AR_FIRST_TEMP_COEF, the AR_SECOND_TEMP_COEF.

*The configuration please use the Method (refer to Appendix 10 “METHOD”)

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APPENDIX 7. LINK MASTER FUNCTIONS

A7.1 Link Active Scheduler

A link active scheduler (LAS) is a deterministic, centralized bus scheduler that can control communications on an H1 fieldbus segment. There is only one LAS on an H1 fieldbus segment.
A digitalYEWFLO supports the following LAS functions.

1	PN transmission	Identifies a fieldbus device newly connected to the same fieldbus segment. PN is short for Probe Node.
2	PT transmission	Passes a token governing the right to transmit, to a fieldbus device on the same segment. PT is short for Pass Token.
3	CD transmission	Carry out a scheduled transmission to a fieldbus device on the same segment. CD is short for Compel Data.
4	Time synchronization	Periodically transmits the time data to all fieldbus devices on the segment and returns the time data in response to a request from a device.
5	Live list equalization	Sends the live list data to link masters on the same segment.
6	LAS transfer	Transfers the right to be the LAS on the segment to another link master.

A7.2 Link Master

A link master (LM) is any device containing a link active scheduler. There must be at least one LM on a segment. When the LAS on a segment has failed, another LM on the same segment starts working as the LAS.

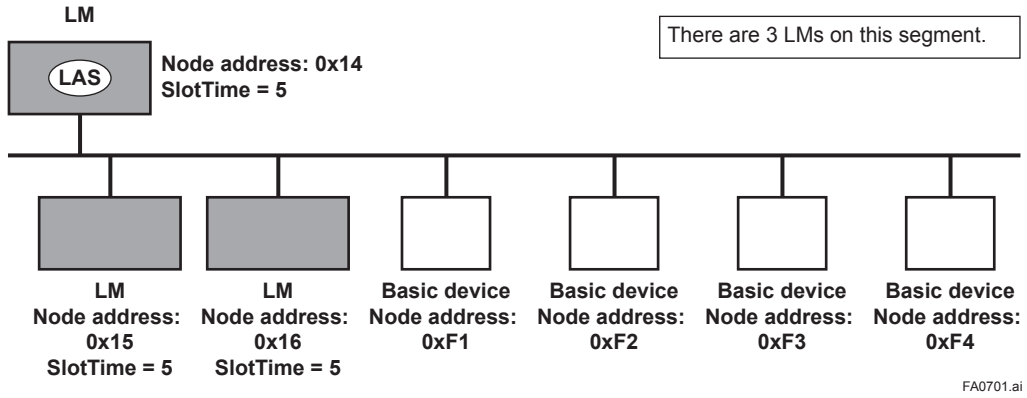


Figure A7.1 Example of Fieldbus configuration-3 LMs on Same Segment

A7.3 Transfer of LAS

There are two procedures for an LM to become the LAS:

(1) If the LM whose value of [V(ST)×V(TN)] is the smallest on a segment, with the exception of the current LAS, judges that there is no LAS on the segment, in such a case as when the segment has started up or when the current LAS has failed, the LM declares itself as the LAS, then becomes the LAS. (With this procedure, an LM backs up the LAS as shown in the following figure.)

(2) The LM whose value of [V(ST)×V(TN)] is the smallest on a segment, with the exception of the current LAS, requests the LAS on the same segment to transfer the right of being the LAS, then becomes the LAS.

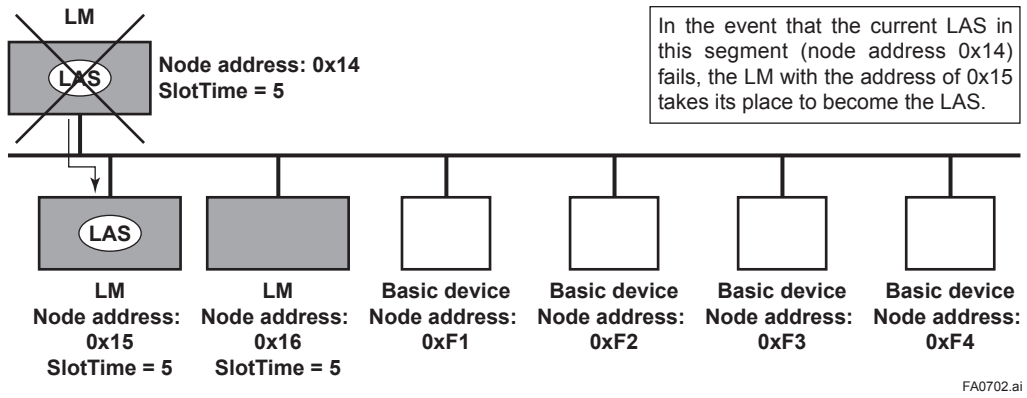


Figure A7.2 Backup of LAS

To set up a digitalYEWFLO as a device that is capable of backing up the LAS, follow the procedure below.

NOTE: When changing the settings in a digitalYEWFLO, add the digitalYEWFLO to the segment in which an LAS is running. After making changes to the settings, do not turn off the power to the digitalYEWFLO for at least 60 seconds.

(1) Set the node address of the digitalYEWFLO. In general, use an address from 0x14 to [V(FUN) – 1].

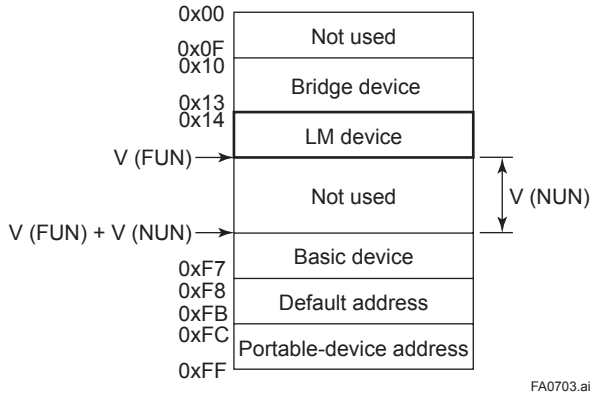


Figure A7.3 Node Address Ranges

(2) In the LAS settings of the digitalYEWFLO, set the values of V(ST), V(MRD), and V(MID) to the same as the respective lowest capability values in all the devices within the segment. An example is shown below.

DlmeBasicInfo (digitalYEWFLO Index 361 (SM))

Sub-index	Element	digital YEWFLO	Device 1	Device 2	Device 3	Description
1	Slot Time	4	8	10	20	Capability value for V(ST)
3	MaxResponse Delay	3	6	3	5	Capability value for V(MRD)
6	MinInterPdu Delay	4	8	12	10	Capability value for V(MID)

In this case, set SlotTime, MaxResponseTime, and MinInterPduDelay as follows:

ConfiguredLinkSettingsRecord (digitalYEWFLO Index 369 (SM))

Subindex	Element	Setting (Default)	Description
1	SlotTime	20 (4095)	V (ST)
3	MaxResponseDelay	6 (5)	V (MRD)
6	MinInterPduDelay	12 (12)	V (MID)

(3) In the LAS settings of the digitalYEWFLO, set the values of V(FUN) and V(NUN) so that they include the node addresses of all nodes within the same segment. (Refer to Figure A7.3.)

ConfiguredLinkSettingsRecord (digitalYEWFLO Index 369 (SM))

Subindex	Element	Default Value	Description
4	FirstUnpolledNodeId	0x25	V (FUN)
7	NumConsecUnpolledNodeId	0xBA	V (NUN)

A7.4 LM Functions

No.	Function	Description
1	LM initialization	When a fieldbus segment starts, the LM with the smallest [V(ST) × V(TN)] value within the segment becomes the LAS. At all times, each LM is checking whether or not a carrier is on the segment.
2	Startup of other nodes (PN and Node Activation SPDU transmissions)	Transmits a PN (Probe Node) message, and Node Activation SPDU message to devices which return a new PR (Probe Response) message.
3	PT transmission (including final bit monitoring)	Passes a PT (Pass Token) message to devices included in the live list sequentially, and monitors the RT (Return Token) and final bit returned in reply to the PT.
4	CD transmission	Transmits a CD (Compel Data) message at the scheduled times.
5	Time synchronization	Supports periodic TD (Time Distribution) transmissions and transmissions of a reply to a CT (Compel Time).
6	Domain download server	Sets the schedule data. The schedule data can be equalized only when the Domain Download command is carried out from outside the LM in question. (The version of the schedule is usually monitored, but no action takes place, even when it changes.)
7	Live list equalization	Transmits SPDU messages to LMs to equalize live lists.
8	LAS transfer	Transfers the right of being the LAS to another LM.
9	Reading/writing of NMIB for LM	Refer to APPENDIX 7.5 “LM Parameters.”
10	Round Trip Delay Reply (RR) Reply to DLPDU	Not yet supported in the current version.
11	Long address	Not yet supported in the current version.

A7.5 LM Parameters

A7.5.1 LM Parameter List

The tables below show LM parameters of a digitalYEWFLO.

Meanings of **Access** column entries: RW = read/write possible; R = read only

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
362	DLME_LINK_MASTER_CAPABILITIES_VARIABLE		0x04	RW	
363	DLME_LINK_ MASTER_ INFO_ RECORD	0		RW	
		1 MaxSchedulingOverhead	0		
		2 DefMinTokenDelegTime	100		
		3 DefTokenHoldTime	300		
		4 TargetTokenRotTime	4096		
		5 LinkMaintTokHoldTime	400		
		6 TimeDistributionPeriod	5000		
		7 MaximumInactivityToClaimLasDelay	8		
		8 LasDatabaseStatusSpduDistributionPeriod	6000		
364	PRIMARY_LINK_MASTER_FLAG_VARIABLE		–	RW	LAS: True = 0xFF non-LAS: False = 0x00
365	LIVE_LIST_STATUS_ARRAY_VARIABLE		–	R	
366	MAX_TOKEN_HOLD_ TIME_ARRAY	0		RW	
		1 Element1	0x0000×16, 0x012c×16		
		2 Element2	0x012c×5, 0x0000×27		
		3 Element3	0x0000×32		
		4 Element4	0x0000×32		
		5 Element5	0x0000×32		
		6 Element6	0x0000×32		
		7 Element7	0x0000×31, 0x012c×1		
		8 Element8	0x012c×32		
367	BOOT_OPERAT_FUNCTIONAL_CLASS		Specified at the time of order	RW	0x01 (Standard); 0x02 (LM)
368	CURRENT_LINK_ SETTING_RECORD	0		R	Settings for LAS
		1 SlotTime			
		2 PerDlpduPhlOverhead			
		3 MaxResponseDelay			
		4 FirstUnpolledNodeId			
		5 ThisLink			
		6 MinInterPduDelay			
		7 NumConseeUnpolledNodeId			
		8 PreambleExtension			
		9 PostTransGapExtension			
		10 MaxInterChanSignalSkew			
		11 TimeSyncClass			
369	CONFIGURED_LINK_ SETTING_RECORD	0	4095	RW	
		1 SlotTime	4		
		2 PerDlpduPhlOverhead	5		
		3 MaxResponseDelay	37		
		4 FirstUnpolledNodeId	0		
		5 ThisLink	12		
		6 MinInterPduDelay	186		
		7 NumConseeUnpolledNodeId	2		
		8 PreambleExtension	1		
		9 PostTransGapExtension	0		
		10 MaxInterChanSignalSkew	4		
		11 TimeSyncClass			

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
370	PLME_BASIC_ CHARACTERISTICS	0		R	
		1 ChannelStatisticsSupported	0x00		
		2 MediumAndDataRatesSupported	0x4900000000000000		
		3 IecVersion	1 (0x1)		
		4 NumOfChannels	1 (0x1)		
		5 PowerMode	0 (0x0)		
371	CHANNEL_STATES	0		R	
		1 channel-1	0 (0x0)		
		2 channel-2	128 (0x80)		
		3 channel-3	128 (0x80)		
		4 channel-4	128 (0x80)		
		5 channel-5	128 (0x80)		
		6 channel-6	128 (0x80)		
		7 channel-7	128 (0x80)		
		8 channel-8	128 (0x80)		
372	PLME_BASIC_INFO	0		R	
		1 InterfaceMode	0 (0x0)		
		2 LoopBackMode	0 (0x0)		
		3 XmitEnabled	1 (0x1)		
		4 RcvEnabled	1 (0x1)		
		5 PreferredReceiveChannel	1 (0x1)		
		6 MediaTypeSelected	73 (0x49)		
		7 ReceiveSelect	1 (0x1)		
373	LINK_SCHEDULE_ACTIVATION_VARIABLE			RW	
374	LINK_ SCHEDULE_LIST_ CHARACTERISTICS_ RECORD	0		R	
		1 NumOfSchedules	0		
		2 NumOfSubSchedulesPerSchedule	1		
		3 ActiveScheduleVersion	0		
		4 ActiveSheduleOdIndex	0		
		5 ActiveScheduleStartingTime	0		
375	DLME_SCHEDULE_ DESCRIPTOR.1	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
376	DLME_SCHEDULE_ DESCRIPTOR.2	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
		3 TimeResolution	0		
377	DOMAIN.1				Read/write impossible. Get-OD possible.
378	DOMAIN.2				Read/write impossible. Get-OD possible.

A7.5.2 Descriptions for LM Parameters

The following describes LM parameters of digitalYEWFLO.

NOTE: Do not turn off the power to the digitalYEWFLO for 60 seconds after making a change to its parameter settings.

(1) DlmeLinkMasterCapabilitiesVariable

Bit Position	Meaning	Description	Value
B3: 0x04	LAS Schedule in Non-volatile Memory	Whether the LAS schedule can (= 1) or cannot (= 0) be saved to the non-volatile memory	1
B2: 0x02	Last Values Record Supported	Whether to support (= 1) or not to support (= 0) LastValuesRecord.	0
B1: 0x01	Link Master Statistics Record Supported	Whether to support (= 1) or not to support (= 0) DlmeLinkMasterStatisticsRecord.	0

(2) DlmeLinkMasterInfoRecord

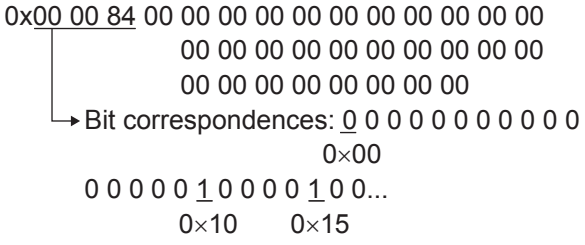
Sub-index	Element	Size [bytes]	Descrip-tion
1	MaxSchedulingOverhead	1	V(MSO)
2	DefMinTokenDelegTime	2	V(DMDT)
3	DefTokenHoldTime	2	V(DTHT)
4	TargetTokenRotTime	2	V(TTRT)
5	LinkMaintTokHoldTime	2	V(LTHT)
6	TimeDistributionPeriod	4	V(TDP)
7	MaximumInactivityToClaimLasDelay	2	V(MICD)
8	LasDatabaseStatusSpduDistributionPeriod	2	V(LDDP)

(3) PrimaryLinkMasterFlagVariable

Explicitly declares the LAS. Writing “true” (0xFF) to this parameter in a device causes that device to attempt to become the LAS. However, a request of writing “true” to this parameter in a device is rejected if the value of the same parameter in any other device that has a smaller node address within the same segment is true.

(4) LiveListStatusArrayVariable

A 32-byte variable, in which each bit represents the status of whether a device on the same segment is live or not. The leading bit corresponds to the device address 0x00, and final bit to 0xFF. The value of LiveListStatusArrayVariable in the case where devices having the addresses 0x10 and 0x15 in the fieldbus segment is shown below.



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(5) MaxTokenHoldTimeArray

An 8 × 64-byte variable, in which each set of 2 bytes represents the delegation time (set as an octet time) assigned to a device. The delegation time denotes a time period that is given to a device by means of a PT message sent from the LAS within each token circulation cycle.
The leading 2 bytes correspond to the device address 0x00, and the final 2 bytes to the device address 0xFF. Specify the subindex to access this parameter.

(6) BootOperatFunctionalClass

Writing 1 to this parameter in a device and restarting the device causes the device to start as a basic device. On the contrary, writing 2 to this parameter and restarting the device causes the device to start as an LM.

(7) CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord

CurrentLinkSettingRecord indicates the bus parameter settings currently used. ConfiguredLinkSettingsRecord indicates the bus parameter settings to be used when the device becomes the LAS. Thus, when a device is the LAS, its CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord have the same values.

Sub-index	Element	Size [bytes]	Descrip-tion
1	SlotTime	2	V(ST)
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	V(MRD)
4	FirstUnpolledNodeId	1	V(FUN)
5	ThisLink	2	V(TL)
6	MinInterPduDelay	1	V(MID)
7	NumConsecUnpolledNodeId	1	V(NUN)
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)
11	TimeSyncClass	1	V(TSC)

(8) DlmeBasicInfo

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	Indicates the capability value for V(ST) of the device.
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	Indicates the capability value for V(MRD) of the device.
4	ThisNode	1	V(TN), node address
5	ThisLink	2	V(TL), link-id
6	MinInterPduDelay	1	Indicates the capability value for V(MID) of the device.
7	TimeSyncClass	1	Indicates the capability value for V(TSC) of the device.
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)

(9) PlmeBasicCharacteristics

Sub-index	Element	Size [bytes]	Value	Description
1	Channel Statistics Supported	1	0	Statistics data are not supported.
2	Medium AndData Rates Supported	8	0x49 00 00 00 00 00 00 00	Wire medium, voltage mode, and 31.25 kbps are supported.
3	IceVersion	2	0x0403	IEC 4.3 is supported.
4	NumOf Channels	1	1	
5	Power Mode	1	0	0: Bus-powered; 1: Self-powered

(10) ChannelStates

Sub-index	Element	Size [bytes]	Value	Description
1	Channel 1	1	0x00	In Use, No Bad since last read, No Silent since last read, No Jabber since last read, Tx Good, Rx Good
2	Channel 2	1	0x80	Unused
3	Channel 3	1	0x80	Unused
4	Channel 4	1	0x80	Unused
5	Channel 5	1	0x80	Unused
6	Channel 6	1	0x80	Unused
7	Channel 7	1	0x80	Unused
8	Channel 8	1	0x80	Unused

(11) PlmeBasicInfo

Sub-index	Element	Size [bytes]	Value	Description
1	InterfaceMode	1	0	0: Half duplex; 1: Full duplex
2	LoopBackMode	1	0	0: Disabled; 1: MAU; 2: MDS
3	XmitEnabled	1	0x01	Channel 1 is enabled.
4	RcvEnebled	1	0x01	Channel 1 is enabled.
5	PreferredReceive Channel	1	0x01	Channel 1 is used for reception.
6	MediaType Selected	1	0x49	Wire medium, voltage mode, and 31.25 kbps are selected.
7	ReceiveSelect	1	0x01	Channel 1 is used for reception.

(12) LinkScheduleActivationVariable

Writing the version number of an LAS schedule, which has already been downloaded to the domain, to this parameter causes the corresponding schedule to be executed. On the other hand, writing 0 to this parameter stops execution of the active schedule.

(13) LinkScheduleListCharacteristicsRecord

Sub-index	Element	Size [bytes]	Description
1	NumOf Schedules	1	Indicates the total number of LAS schedules that have been downloaded to the domain.
2	NumOfSub SchedulesPer Schedule	1	Indicates the maximum number of sub-schedules an LAS schedule can contain. (This is fixed to 1 in the Yokogawa communication stacks.)
3	ActiveSchedule Version	2	Indicates the version number of the schedule currently executed.
4	ActiveSchedule OdIndex	2	Indicates the index number of the domain that stores the schedule currently executed.
5	ActiveSchedule StaringTime	6	Indicates the time when the current schedule began being executed.

(14) DlmeScheduleDescriptor

This parameter exists for the same number as the total number of domains, and each describes the LAS schedule downloaded to the corresponding domain. For the domain to which a schedule has not yet been downloaded, the values in this parameter are all zeros.

Sub-index	Element	Size [bytes]	Description
1	Version	2	Indicates the version number of the LAS schedule downloaded to the corresponding domain.
2	Macrocycle Duration	4	Indicates the macro cycle of the LAS schedule downloaded to the corresponding domain.
3	TimeResolution	2	Indicates the time resolution that is required to execute the LAS schedule downloaded to the corresponding domain.

(15) Domain

Read/write: impossible; get-OD: possible
Carrying out the GenericDomainDownload command from a host writes an LAS schedule to the domain.

A7.6 Trouble Shooting

Q1. When the LAS stops, a digitalYEWFLO does not back it up by becoming the LAS. Why?

A1-1. Is that digitalYEWFLO running as an LM? Check that the value of BootOperatFunctionalClass (index 367) is 2 (indicating that it is an LM).

A1-2. Check the values of V(ST) and V(TN) in all LMs on the segment and confirm that the following condition is met:

digitalYEWFLO		Other LMs
V(ST) × V(TN)	<	V(ST) × V(TN)

Q2. How can I make a digitalYEWFLO become the LAS?

A2-1. Check that the version numbers of the active schedules in the current LAS and the digitalYEWFLO are the same by reading:
LinkScheduleListCharacteristicsRecord (index 374 for a digitalYEWFLO)
- ActiveScheduleVersion (subindex 3)

A2-2. Make the digitalYEWFLO declare itself as and become the LAS by writing:
- 0x00 (false) to PrimaryLinkMasterFlagVariable in the current LAS; and
- 0xFF (true) to PrimaryLinkMasterFlagVariable (index 364) in the digitalYEWFLO.

Q3. On a segment where a digitalYEWFLO works as the LAS, another device cannot be connected. Why?

A3-1. Check the following bus parameters that indicate the bus parameter as being the LAS for the digitalYEWFLO and the capabilities of being the LAS for the device that cannot be connected:
- V(ST), V(MID), and V(MRD) of digitalYEWFLO: ConfiguredLinkSettingsRecord (index 369)
- V(ST), V(MID), and V(MRD) of problematic device: DlmeBasicInfo

Then, confirm that the following conditions are met:

digitalYEWFLO		Problematic Device
V(ST)	>	V(ST)
V(MID)	>	V(MID)
V(MRD)	>	V(MRD)

A3-2. Check that the node address of the problematic device does not lie within either 0x00 to 0x10 or the range of unused (unpolled) node addresses determined by the digitalYEWFLO's LM parameter settings, which is 0x00 to 0x10 or V(FUN) to V(FUN) + V(NUM). (Refer to Section 5.2 "Network Definition.")

Q4. The LCD keeps showing "— — —". It is presumed that an LAS does not exist on the bus or the digitalYEWFLO cannot establish communication with the LAS. What should be done?

A4-1. Check that an LAS is connected on the bus. (When using the digitalYEWFLO as the LAS [which requires an option], perform steps (1) to (3) in APPENDIX 7.3 "Transfer of LAS.")

A4-2. Make the parameters in the current LAS match the capabilities parameter in the digitalYEWFLO as follows (Refer to Section 5.2 “Network Definition”):

LAS		digitalYEWFLO
V(ST)	>	V(ST) ≥ 4
V(MID)	>	V(MID) ≥ 4
V(MRD)	>	V(MRD) ≥ 12

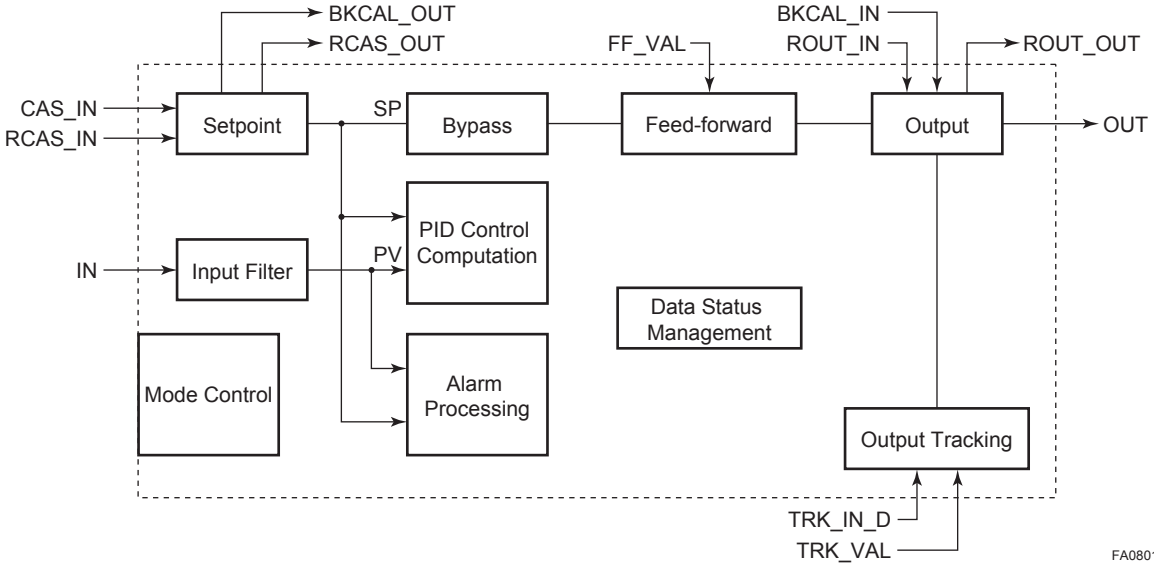
A4-3. Check that the digitalYEWFLO is assigned an appropriate address. The address of the digitalYEWFLO must not lie within either 0x00 to 0x10 or the range of unused (unpolled) node addresses determined by the current LAS’s LM parameter settings, which is V(FUN) to V(FUN) + V(NUM). (Refer to Section 5.2 “Network Definition.”)

APPENDIX 8. PID BLOCK

A PID block performs the PID control computation based on the deviation of the measured value (PV) from the setpoint (SV), and is generally used for constant-setpoint and cascaded-setpoint control.

A8.1 Function Diagram

The figure below depicts the function diagram of a PID block.



A8.2 Functions of PID Block

The table below shows the functions provided in a PID block.

Function	Description
PID control computation	Computes the control output in accordance with the PID control algorithm.
Control output	Converts the change in control output ΔMV to the manipulated value MV that is to be actually output.
Switching of direction of control action	Switches over the direction of control action between direct and reverse, i.e., the direction of changes in the control output depending on the changes in the deviation.
Control action bypass	When the bypass is on, the value of the SP is scaled to the range of the OUT and output as the OUT.
Feed-forward	Adds the value of the FF_VAL (input to the PID block) to the output from the PID computation.
Measured-value tracking	Equalizes the setpoint SP to the measured value PV.
Setpoint limiters	Limit the value of setpoint SP within the preset upper and lower levels as well as limit the rate of change when the PID block is in Auto mode.
External-output tracking	Performs the scaling of the value of TRK_VAL to the range of the OUT and outputs it as the OUT.
Mode change	Changes the block mode between 8 modes: O/S, IMan, LO, Man, Auto, Cas, RCas, ROut.
Bumpless transfer	Prevents a sudden change in the control output OUT at changes in block mode and at switching of the connection from the control output OUT to the cascaded secondary function block.
Initialization and manual fallback	Changes the block mode to IMan and suspends the control action when the specified condition is met.
Manual fallback	Changes the block mode to Man and aborts the control action.
Auto fallback	Changes the block mode to Auto when it is Cas, and continues the control action with the setpoint set by the operator.
Mode shedding upon computer failure	Changes the block mode in accordance with the SHED_OPT setting upon a computer failure.
Alarm processing	Generates block alarms and process alarms, and performs event updates.

A8.3 Parameters of PID Block

NOTE: In the table below, the **Write** column shows the modes in which the respective parameters can be written. A blank in the Write column indicates that the corresponding parameter can be written in all modes of the PID block. A dash (–) indicates that the corresponding parameter cannot be written in any mode.

Index	Parameter Name	Default (factory setting)	Write	Valid Range	Description
0	Block Header	TAG: "PID"	Block Tag = O/S		Same as that for an AI block.
1	ST_REV		–		Same as that for an AI block.
2	TAG_DESC	(blank)			Same as that for an AI block.
3	STRATEGY	0			Same as that for an AI block.
4	ALERT_KEY	1		1 to 255	Same as that for an AI block.
5	MODE_BLK				
6	BLOCK_ERR		–		Same as that for an AI block.
7	PV		–		Measured value; the non-dimensional value that is converted from the input (IN) value based on the PV_ SCALE values and filtered.
8	SP	0	AUTO	PV_SCALE ±10%	Setpoint
9	OUT		MAN		Output
10	PV_SCALE	100 0 1342 (%) 1	O/S		Upper and lower scale limit values used for scaling of the input (IN) value.
11	OUT_SCALE	100 0 1342 (%) 1	O/S		Upper and lower scale limit values used for scaling of the control output (OUT) value to the values in the engineering unit.
12	GRANT_DENY	0	AUTO		Same as that for an AI block.
13	CONTROL_OPTS	0	O/S		Setting for control action. Refer to APPENDIX 8.13 "Measured-value Tracking" for details.
14	STATUS_OPTS	0	O/S		Refer to APPENDIX 8.15 "Manual Fallback" for details.
15	IN	0			Controlled-value input
16	PV_FTIME	0sec	AUTO	Non-negative	Time constant (in seconds) of the first-order lag filter applied to IN
17	BYPASS	1 (off)	MAN	1, 2	Whether to bypass the control computation. 1 (off): Do not bypass. 2 (on): Bypass.
18	CAS_IN	0			Cascade setpoint
19	SP_RATE_DN	1.#INF		Positive	Rate-of-decrease limit for setpoint (SP)
20	SP_RATE_UP	1.#INF		Positive	Rate-of-increase limit for setpoint (SP)
21	SP_HI_LIM	100		PV_SCALE ±10%	Upper limit for setpoint (SP)
22	SP_LO_LIM	0		PV_SCALE ±10%	Lower limit for setpoint (SP)
23	GAIN	1			Proportional gain (= 100 / proportional band)
24	RESET	10			Integration time (seconds)
25	BAL_TIME	0		Positive	Unused
26	RATE	0		Positive	Derivative time (seconds)
27	BKCAL_IN	0			Read-back of control output
28	OUT_HI_LIM	100		OUT_SCALE ±10%	Upper limit for control output (OUT)
29	OUT_LO_LIM	0		OUT_SCALE ±10%	Lower limit for control output (OUT)
30	BKCAL_HYS	0.5 (%)		0 to 50%	Hysteresis for release from a limit for OUT.status
31	BKCAL_OUT	0	–		Read-back value to be sent to the BKCAL_IN in the upper block
32	RCAS_IN	0			Remote setpoint set from a computer, etc.
33	ROUT_IN	0			Remote control output value set from a computer, etc.
34	SHED_OPT	0			Action to be performed in the event of mode shedding. SHED_OPT defines the changes to be made to MODE. BLK.target and MODE.BLK.actual when the value of RCAS_IN.status or ROUT_IN.status becomes Bad if MODE_BLK.actual = RCas or ROut. Refer to APPENDIX 8.17 "Mode Shedding upon Computer Failure."
35	RCAS_OUT	0	–		Remote setpoint sent to a computer, etc.

Index	Parameter Name	Default (factory setting)	Write	Valid Range	Description
36	ROUT_OUT	0	–		Remote control output value
37	TRK_SCALE	100 0 1342 (%) 1	MAN		Upper and lower scale limits used to convert the output tracking value (TRK_VAL) to non-dimensional.
38	TRK_IN_D	0			Switch for output tracking. Refer to APPENDIX 8.12 “External-output Tracking” for details.
39	TRK_VAL	0			Output tracking value (TRK_VAL) When MODE_BLK.actual = LO, the value scaled from the TRK_VAL value is set in OUT.
40	FF_VAL	0			Feedforward input value. The FF_VAL value is scaled to a value with the same scale as for OUT, multiplied by the FF_GAIN value, and then added to the output of the PID computation.
41	FF_SCALE	100 0 1342 (%) 1	MAN		Scale limits used for converting the FF_VAL value to a non-dimensional value.
42	FF_GAIN	0	MAN		Gain for FF_VAL
43	UPDATE_EVT		–		Same as that for an AI block.
44	BLOCK_ALM		–		Same as that for an AI block.
45	ALARM_SUM	Enable			Same as that for an AI block.
46	ACK_OPTION	0			Same as that for an AI block.
47	ALARM_HYS	0.5%		0 to 50%	Hysteresis for alarm detection and resetting to prevent each alarm from occurring and recovering repeatedly within a short time.
48	HI_HI_PRI	0		0 to 15	Priority order of HI_HI_ALM alarm
49	HI_HI_LIM	1.#INF		PV_SCALE	Setting for HI_HI_ALM alarm
50	HI_PRI	0		0 to 15	Priority order of HI_ALM alarm
51	HI_LIM	1.#INF		PV_SCALE	Setting for HI_ALM alarm
52	LO_PRI	0		0 to 15	Priority order of LO_ALM alarm
53	LO_LIM	-1.#INF		PV_SCALE	Setting for LO_ALM alarm
54	LO_LO_PRI	0		0 to 15	Priority order of LO_LO_ALM alarm
55	LO_LO_LIM	-1.#INF		PV_SCALE	Setting for LO_LO_ALM alarm
56	DV_HI_PRI	0		0 to 15	Priority order of DV_HI_ALM alarm
57	DV_HI_LIM	1.#INF			Setting for DV_HI_ALM alarm
58	DV_LO_PRI	0		0 to 15	Priority order of DV_LO_ALM alarm
59	DV_LO_LIM	-1.#INF			Setting for DV_LO_ALM alarm
60	HI_HI_ALM	–	–		Alarm that is generated when the PV value has exceeded the HI_HI_LIM value and whose priority order* is defined in HI_HI_PRI. * Priority order: Only one alarm is generated at a time. When two or more alarms occur at the same time, the alarm having the highest priority order is generated. When the PV value has decreased below [HI_HI_LIM – ALM_HYS], HI_HI_ALM is reset.
61	HI_ALM	–	–		As above
62	LO_ALM	–	–		As above Reset when the PV value has increased above [LO_LIM + ALM_HYS].
63	LO_LO_ALM	–	–		As above
64	DV_HI_ALM	–	–		Alarm that is generated when the value of [PV - SP] has exceeded the DV_HI_LIM value. Other features are the same as HI_HI_ALM.
65	DV_LO_ALM	–	–		Alarm that is generated when the value of [PV - SP] has decreased below the DV_LO_LIM value. Other features are the same as LO_LO_ALM.

A8.4 PID Computation Details

For PID control, the PID block in a digitalYEWFLO employs the PV-proportional and -derivative type PID control algorithm (referred to as the I-PD control algorithm), or the PV-derivative type PID control algorithm (referred to as the PI-D control algorithm) depending on the mode, as described below.

- **PV-proportional and -derivative Type PID (I-PD) Control Algorithm versus PV-derivative Type PID (PI-D) Control Algorithm**

The I-PD control algorithm, which is expressed by the equation below, ensures control stability against sudden changes in the setpoint, such as when the user enters a new setpoint value. The I-PD algorithm also ensures excellent controllability by performing proportional, integral, and derivative control actions in response to changes of characteristics in the controlled process, changes in load, and occurrences of disturbances.
When the PID block is in Auto or RCas mode, this I-PD algorithm is used for control. In Cas mode, however, the PV-derivative type PID (PI-D) algorithm takes over since the response to setpoint changes is more important. The control algorithm in use thus switches over automatically in line with the mode transitions. The following shows the basic computation formulas of these algorithms.

PV-proportional and -derivative (I-PD) control algorithm:

$$\Delta MVn = K\left\{\Delta PVn + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn)\right\}$$

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PV-derivative (PI-D) control algorithm:

$$\Delta MVn = K\left\{\Delta(PVn - SPn) + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn)\right\}$$

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Where,

ΔMVn = change in control output
ΔPVn = change in measured (controlled) value = PVn - PVn-1
ΔT = control period = period_of_execution in Block Header
K = proportional gain = GAIN (= 100/ proportional band)
TI = integral time = RESET
T_D = derivative time = RATE

The subscripts, n and n-1, represent the time of sampling such that PVn and PVn-1 denote the PV value sampled most recently and the PV value sampled at the preceding control period, respectively.

- **PID Control Parameters**

The table below shows the PID control parameters.

Parameter	Description	Valid Range
GAIN	Proportional gain	0.05 to 20
RESET	Integral time	0.1 to 10,000 (seconds)
RATE	Derivative time	0 to infinity (seconds)

A8.5 Control Output

The final control output value, MV, is computed based on the change in control output ΔMVn, which is calculated at each control period in accordance with the aforementioned algorithm. The PID block in a digitalYEWFLO performs the velocity type output action for the control output.

- **Velocity Type Output Action**

The PID block determines the control output (OUT) value by adding the change in control output calculated in the current control period, ΔMVn, to the value read back from the output destination, BKCAL_IN. This velocity type output action can be expressed as:

$$OUT = BKCAL_IN - \Delta MVn'$$

where $\Delta MVn'$ is ΔMVn scaled based on PV_SCALE and OUT_SCALE.
Note: MV indicates the PID computation result.

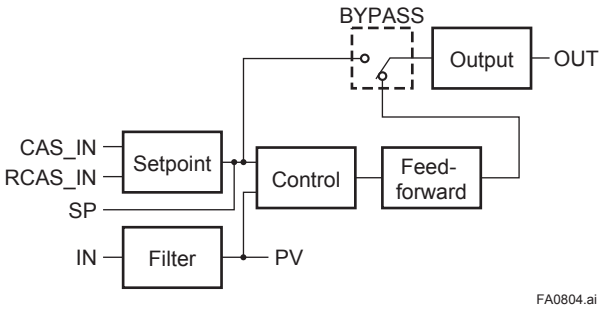
A8.6 Direction of Control Action

The direction of the control action is determined by the Direct Acting setting in CONTROL_OPTS.

Value of Direct Acting	Resulting Action
True	The output increases when the input PV is greater than the setpoint SP.
False	The output decreases when the input PV is greater than the setpoint SP.

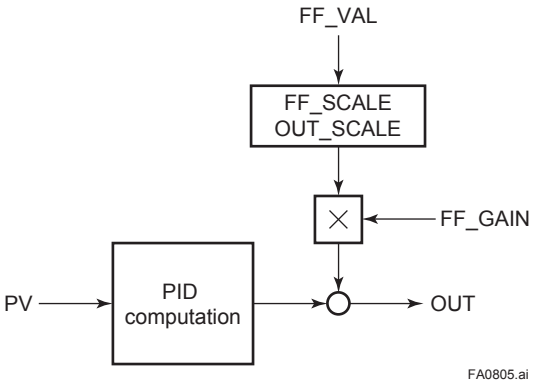
A8.7 Control Action Bypass

The PID control computation can be bypassed so as to set the SP value in the control output OUT as shown below. Setting BYPASS to “On” bypasses the PID control computation.



A8.8 Feed-forward

Feed-forward is an action to add a compensation input signal FF_VAL to the output of the PID control computation, and is typically used for feed-forward control. The following figure illustrates the action.



A8.9 Block Modes

The block mode is set in the parameter MODE_BLK.

MODE_BLK	Target	Stipulates the target mode to which the PID block transfers.
	Actual	Indicates the current mode of the PID block.
	Permitted	Stipulates all the modes that the PID block can enter. The PID block is prohibited to enter any mode other than those set in this element.
	Normal	Stipulates the mode in which the PID block normally resides.

There are eight modes for a PID block as shown below.

Block Mode	Description
ROut	Remote output mode, in which the PID block outputs the value set in ROUT_IN.
RCas	Remote cascade mode, in which the PID block carries out the PID control computation based on the setpoint (SP) set via the remote cascade connection, such as from a computer, and outputs the computed result.
Cas	Cascade mode, in which the PID block carries out the PID control computation based on the setpoint (SP) set from another fieldbus function block, and outputs the computed result.
Auto	The PID block carries out automatic control and outputs the result computed by the PID control computation.
Man	Manual mode, in which the PID block outputs the value set by the user manually.
LO	The PID block outputs the value set in TRK_VAL.
IMan	Initialization and manual mode, in which the control action is suspended. The PID block enters this mode when the specified condition is met (Refer to APPENDIX 8.14 “Initialization and Manual Fallback (IMAN)”).
O/S	Out of service mode, in which neither the control computation nor action is carried out, and the output is kept at the value that was output before the PID block entered into O/S mode.

Mode Transitions

	Transition Destination Mode	Condition	NOT Conditions
1	O/S	If O/S is set in **MODE_ BLK. target** (or if O/S is set in **target** inside the resource block)	
2	IMan	If the specified condition is met (refer to APPENDIX 8.14 “Initialization and Manual Fallback (IMAN).”)	**NOT** if condition 1 is met
3	LO	If Track Enable is specified in **CONTROL_OPTS** and the value of **TRK_IN_D** is true	**NOT** if either or both of conditions 1 and 2 are met
4	Man	If Man is set in **MODE_ BLK. target** or if **IN.status** (input status) is Bad	**NOT** if any one or more of conditions 1 to 3 are met
5	Auto*	If Auto is set in **MODE_ BLK. target** **- AND -** if **IN.status** (input status) is not Bad	**NOT** if any one or more of conditions 1 to 3 are met
6	Cas*, **	If Cas is set in **MODE_ BLK. target** **- AND -** if neither **IN.status** (input status) nor **CAS_IN.status** is Bad.	**NOT** if any one or more of conditions 1 to 3 are met
7	RCas*, **	If RCas is set in **MODE_ BLK.target** **- AND -** if neither **IN.status** (input status) nor **RCAS_IN.status** is Bad.	**NOT** if any one or more of conditions 1 to 3 are met.
8	ROut*, **	If ROut is set in **MODE_ BLK. target** **- AND -** if **ROUT_IN.status** (input status) is not Bad	**NOT** if any one or more of conditions 1 to 3 are met.
9	In accordance with the **SHED_OPT** setting	If **RCAS_IN.status** or **ROUT_ IN.status** is Bad (indicating a computer failure; Refer to APPENDIX 8.17 “Mode Shedding upon Computer Failure” for details)	

* To activate mode transitions to AUTO, CAS, RCAS, and ROUT, the respective target modes must be set beforehand to MODE_BLK.permitted.

** A transition to CAS, RCAS, or ROUT requires that initialization of the cascade connection has been completed.

A8.10 Bumpless Transfer

Prevents a sudden change in the control output OUT at changes in block mode (MODE_BLK) and at switching of the connection from the control output OUT to the cascaded secondary function block. The action to perform a bump less transfer differs depending on the MODE_BLK values.

A8.11 Setpoint Limiters

Active setpoint limiters that limit the changes in the SP value, differ depending on the block mode as follows.

A8.11.1 When PID Block is in AUTO Mode

When the value of MODE_BLK is AUTO, the four types of limiters are in force: high limit, low limit, rate-of-increase limit, and rate-of-decrease limit.

- **Setpoint High/Low Limits**
  - A value larger than the value of SP_HI_LIM cannot be set for SP.
  - A value smaller than the value of SP_LO_LIM cannot be set for SP.
- **Setpoint Rate Limits**

The setpoint rate limits are used to restrict the magnitude of changes in the SP value so as to change the SP value gradually towards a new setpoint.

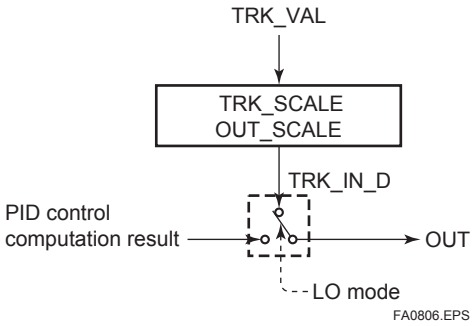
- An increase of the SP value at each execution period (period of execution in the Block Header) is limited to the value of SP_RATE_UP.
- A decrease of the SP value at each execution period (period of execution in the Block Header) is limited to the value of SP_RATE_DOWN.

A8.11.2 When PID Block is in CAS or RCAS Mode

By selecting Obey SP Limits if Cas or RCas in CONTROL_OPTS (Refer to APPENDIX 8.13 “Measured-value Tracking”), the setpoint high/low limits can be put into force also when the value of MODE_BLK is CAS or RCAS.

A8.12 External-output Tracking

External tracking is an action of outputting the value of the remote output TRK_VAL set from outside the PID block, as illustrated in the figure below. External tracking is performed when the block mode is LO.



To change the block mode to LO:
(1) Select Track Enable in CONTROL_OPTS.
(2) Set TRK_IN_D to true.

However, to change the block mode from MAN to LO, Track in Manual must also be specified in CONTROL_OPTS.

A8.13 Measured-value Tracking

Measured-value tracking, also referred to as SP-PV tracking, is an action to equalize the setpoint SP to the measured value PV when the block mode (MODE_BLK.actual) is MAN in order to prevent a sudden change in control output from being caused by a mode change to AUTO.
While a cascade primary control block is performing the automatic or cascade control (in the AUTO or CAS mode), when the mode of its secondary control block is changed from CAS to AUTO, the cascade connection is opened and the control action of the primary block stops. The SP of the primary controller can be equalized to its cascade input signal CAS_IN also in this case.
The settings for measured-value tracking are made in the parameter CONTROL_OPTS, as shown in the table below.

- **CONTROL_OPTS**

Options in CONTROL_OPTS	Description
Bypass Enable	This parameter allows BYPASS to be set.
SP-PV Track in Man	Equalizes SP to PV when **MODE_BLK. target** is set to Man.
SP-PV Track in ROut	Equalizes SP to PV when **MODE_BLK. target** is set to ROut.
SP-PV Track in LO or IMan	Equalizes SP to PV when **actual** is set to LO or IMAN.
SP-PV Track retained Target	Equalizes SP to RCAS_IN when **MODE_ BLK.target** is set to RCas, and to CAS_IN when **MODE_BLK.target** is set to Cas when the actual mode of the block is IMan, LO, Man or ROut.
Direct Acting	Set the PID block to a direct acting controller.
Track Enable	This enables the external tracking function. The value in TRK_VAL will replace the value of OUT if TRK_IN_D becomes true and the target mode is not Man.
Track in Manual	This enables TRK_VAL to replace the value of OUT when the target mode is Man and TRK_IN_D is true. The actual mode will then be LO.
Use PV for BKCAL_OUT	Sets the value of PV in BKCAL_OUT and RCAS_OUT, instead of the value of SP.
Obey SP limits if Cas or RCas	Puts the setpoint high/low limits in force in the Cas or RCas mode.
No OUT limits in Manual	Disables the high/low limits for OUT in the Man mode.

A8.14 Initialization and Manual Fallback (IMAN)

Initialization and manual fallback denotes a set of actions in which a PID block changes mode to IMAN (initialization and manual) and suspends the control action. Initialization and manual fallback takes place automatically as a means of abnormality handling when the following condition is met:

- The quality component of BKCAL_IN.status is Bad.

- OR -

- The quality component of BKCAL_IN.status is Good (c)
  - AND -
  The sub-status component of BKCAL_IN.status is FSA, LO, NI, or IR.

The user cannot manually change the mode to IMAN. A mode transition to IMAN occurs only when the condition above is met.

A8.15 Manual Fallback

Manual fallback denotes an action in which a PID block changes mode to MAN (manual) and suspends the control action. Manual fallback takes place automatically as a means of abnormality handling when the following condition is met:

- IN.status is Bad except when the control action bypass is on.

To enable the manual fallback action to take place when the above condition is met, Target to Manual if Bad IN must be specified beforehand in STATUS_OPTS.
The table below shows the options in STATUS_OPTS.

- **STATUS_OPTS**

Options in STATUS_OPTS	Description
IFS if Bad IN	Sets the sub-status component of **OUT. status** to IFS if **IN.status** is Bad except when PID control bypass is on.
IFS if Bad CAS IN	Sets the sub-status component of **OUT. status** to IFS if **CAS_IN.status** is Bad.
Use Uncertain as Good	Does not regard **IN** as being in Bad status when **IN.status** is Uncertain (to prevent mode transitions from being affected when it is Uncertain).
Target to Manual if Bad IN	Automatically changes the value of **MODE_BLK.target** to MAN when **IN** falls into Bad status.
Target to next permitted mode if Bad CAS IN	Automatically changes the value of **MODE_BLK.target** to Auto (or to Man if Auto is not set in Permitted) when **CAS_IN** falls into Bad status.

A8.16 Auto Fallback

Auto fallback denotes an action in which a PID block changes mode from CAS (cascade) to AUTO (automatic) and continues automatic PID control with the user-set setpoint. Auto fallback takes place automatically when the following condition is met:

- IN.status (data status of IN) is Bad except when the control action bypass is on.

To enable the manual fallback action to take place when the above condition is met:

- Target to next permitted mode if Bad CAS IN must be previously specified in STATUS_OPTS.

- AND -

- AUTO must be previously set in MODE_BLK. permitted.

A8.17 Mode Shedding upon Computer Failure

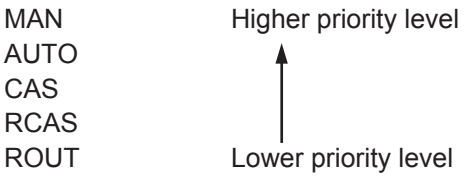
When the data status of RCAS_IN or ROUT_IN, which is the setting received from a computer as the setpoint SP, falls to Bad while the PID block is running in the RCAS (remote cascade) or ROUT (remote output) mode, the mode shedding occurs in accordance with the settings in SHED_OPT.

- **SHED_OPT**

The SHED_OPT setting stipulates the specifications of mode shedding as shown below. Only one can be set.

Available Setting for SHED_OPT	Actions upon Computer Failure
Normal shed, normal return	Sets **MODE_BLK.actual** to Cas*, and leaves **MODE_BLK.target** unchanged.
Normal shed, no return	Sets both **MODE_BLK.actual** and **MODE_BLK.target** to Cas*.
Shed to Auto, normal return	Sets **MODE_BLK.actual** to Auto**, and leaves **MODE_BLK.target** unchanged.
Shed to Auto, no return	Sets both **MODE_BLK.actual** and **MODE_BLK.target** to Auto**.
Shed to Manual, normal return	Sets **MODE_BLK.actual** to Man, and leaves **MODE_BLK.target** unchanged.
Shed to Manual, no return	Sets both **MODE_BLK.actual** and **MODE_BLK.target** to Man.
Shed to retained target, normal return	If Cas is in **MODE_BLK.target**, sets **MODE_BLK.actual** to Cas*, and leaves **MODE_BLK.target** unchanged. If Cas is not set in **MODE_BLK.target**, sets **MODE_BLK.actual** to Auto**, and leaves **MODE_BLK.target** unchanged.
Shed to retained target, no return	If Cas is set in **MODE_BLK.target**, sets both **MODE_BLK.actual** and **MODE_BLK.target** to Cas*. If Cas is not set in **MODE_BLK.target**, sets **MODE_BLK.actual** to Auto**, and **MODE_BLK.target** to Cas.

* The modes to which a PID block can transfer are limited to those set in MODE_BLK.permitted, and the priority levels of modes are as shown below. In fact, if Normal shed, normal return is set for SHED_OPT, detection of a computer failure causes MODE_BLK.actual to change to CAS, AUTO, or MAN, whichever is set in MODE_BLK.permitted and has the lowest priority level.



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** Only if Auto is included in MODE_BLK.permitted. If the block upstream of the PID block in question is a control block, mode transitions of the PID block to CAS occur in the following sequence due to initialization of the cascade connection: RCAS or ROUT → AUTO → CAS.

A8.18 Alarms

There are two kinds of alarms generated by a PID block: block and process alarms.

A8.18.1 Block Alarm (BLOCK_ALM)

The block alarm BLOCK_ALM is generated upon occurrence of either of the following errors (values set in BLOCK_ERR) and notifies the content of BLOCK_ERR.

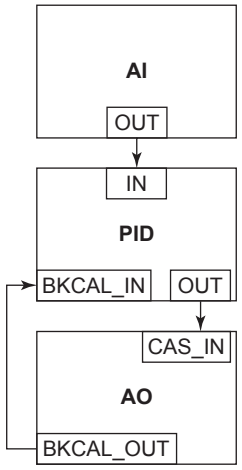
Value of BLOCK_ERR	Condition
Input Failure	**IN.status** of the PID block is either of the following: • Bad-Device Failure • Bad-Sensor Failure
Out of Service	**MODE_BLK.target** of the PID block is O/S.

A8.18.2 Process Alarms

There are six types of process alarms. Only one process alarm can be generated at the same time, and the process alarm having the highest priority level from among those occurring at the same time is generated. The priority level is set for each process alarm type.

Process Alarm	Cause of Occurrence	Parameter Containing Priority Level Setting
HI_HI_ALM	Occurs when the PV increases above the HI_HI_LIM value.	HI_HI_PRI
HI_ALM	Occurs when the PV increases above HI_LIM value.	HI_PRI
LO_ALM	Occurs when the PV decreases below the LO_LIM value.	LO_PRI
LO_LO_ALM	Occurs when the PV decreases below the LO_LO_LIM value.	LO_LO_LIM
DV_HI_ALM	Occurs when the value of [PV - SP] increases above the DV_HI_LIM value.	DV_HI_PRI
DV_LO_ALM	Occurs when the value of [PV - SP] decreases below the DV_LO_LIM value.	DV_LO_PRI

A8.19 Example of Block Connections



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When configuring a simple PID control loop by combining a digitalYEWFLO with a fieldbus valve positioner that contains an AO block, follow the procedure below to make the settings of the corresponding fieldbus function blocks:

1. Connect the AI block and PID block of the digitalYEWFLO, and the AO block of the valve positioner as shown above.
2. Set MODE_BLK.target of the PID block to O/S, and then set GAIN, RESET, and RATE to appropriate values.
3. Check that the value of MODE_BLK.actual of the AI block is AUTO.
4. Set MODE_BLK.target of the AO block to CAS|AUTO (meaning “CAS and AUTO”).
5. Check that the value of BKCAL_IN.status of the PID block is not Bad.
6. Check that the value of IN.status of the PID block is not Bad.
7. Check that AUTO is set in MODE_BLK. permitted of the PID block.
8. Set MODE_BLK.target of the PID block to AUTO.

When finishing all steps in order, the PID block and AO block exchange the respective information and initialize the cascade connection. Consequently, the value of MODE_BLK.actual of the PID block changes to AUTO and automatic PID control starts.

APPENDIX 9. DD MENU

(1) Resource Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Confirm Time
    - Write Lock
    - Feature Info
      - Features
      - Feature Selection
    - Cycle Info
      - Cycle Type
      - Cycle Selection
      - Minumum Cycle Time
    - Notify Info
      - Max Notif
      - Limit Notify
    - Sheding
      - Shed Remote Cascade
      - Shed Remote Out
    - SoftDL Protection
    - SoftDL Format
  - Diagnostics/Alerts
    - Block Error
    - Resource State
    - Fault State
    - Set Fault State
    - Clear Fault State
    - Device Status
      - Device Status 1
      - Device Status 2
      - Device Status 3
      - Device Status 4
      - Device Status 5
      - Device Status 6
      - Device Status 7
      - Device Status 8
    - Alert Parameters
      - Block Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
      - Alarm Sum
        - Current
        - Unacknowledged
        - Unreported
        - Disabled
      - Acknowledge Option
      - Write Priority
      - Write Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Discrete Value
      - Update Event
        - Unacknowledged
        - Update State
        - Time Stamp
        - Static Rev
        - Relative Index
  - Others
    - Restart
    - Grant Deny
      - Grant
      - Deny
    - Sim Enable Message
    - Hardware Info
      - Hard Types
      - Memory Size
      - Nonvolatile Cycle Time
      - Free Space
      - Free Time
    - Identification
      - Manufacturer Id
      - Device Type
      - Device Revision
      - DD Revision
    - Other Info
      - ITK Version
      - Soft Revision
      - Soft Description
    - SoftDL Count
    - SoftDL Act Area
    - SoftDL Module Revision
    - SoftDL Error
  - Query Device
    - RS Standard parameters
    - Enhanced parameters

FA0901.ai

Note: Parameter name may differ according to a tool or host.

(2) Transducer Block

- Transducer Block (Top menu)
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
    - Transducer Directory
    - Transducer Type
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Primary Value
      - Value
      - Status
    - Secondary Value
      - Status
      - Value
      - Secondary Value Unit
    - Tertiary Value
      - Status
      - Value
      - Tertiary Value Unit
    - Volumetric Flow
      - Status
      - Value
      - Volumetric Flow Unit
  - Configuration/Calibration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Setup Wizard
    - General
      - Model
      - Sensor Info
        - Sensor Type
        - Sensor Status
        - Sensor Serial Number
        - Sensor Range
          - EU at 100
          - EU at 0
          - Units Index
          - Decimal
        - Linearization Type
        - Primary Value Type
      - Primary Value Range
        - EU at 100
        - EU at 0
        - Units Index
        - Decimal
      - Transducer Calibration Info
        - Sensor Calibration Method
        - Calibration Highest Point
        - Calibration Lowest Point
        - Calibration Minimum Span
        - Calibration Unit
        - Sensor Calibration Location
        - Sensor Calibration Date
        - Sensor Calibration Who
    - Fluid Condition
      - Fluid Type
        - Sensor Status
        - Fluid Type
        - Thermometer Function
      - Temperature Set
        - Temparature Unit
        - Process Temparature
        - Base Temparature
      - Density Set
        - Density Unit
        - Process Density
        - Base Density
      - Pressure Set
        - Pressure Unit
        - Process Pressure
        - Base Pressure
      - Other Condition set
        - Primary Value Filter Time
        - Deviation
        - First Temperature Coef.
        - Second Temperature Coef.
        - Secondary Value Filter Time
        - Cable Length
    - Characterize Meter
      - Size Select
      - Body Type
      - Vortex Sensor Type
      - K-Factor Unit
      - K-Factor Value
    - Display Set
      - Upper Display Mode
      - Lower Display Mode
      - Display Cycle
    - Adjust
      - Reynolds Adjust
      - Viscosity Value
      - Flow Adjust
      - User Adjust
      - Gas Expansion Fact
    - Maintenance
      - Low Cut Flow
      - Trigger Level
      - Noise Balance Mode
      - Noise Ratio
      - Noise Balance Wizard
      - Signal Level
      - Sensor Error Record
      - Flow Velocity
      - Span Velocity
      - Vortex Frequency
      - Span Frequency
      - Fluid Density
    - Limit Switch 1 Set
      - Limit Switch 1 Value D
        - Status
        - Value
      - Limsw 1 Target
      - Limsw 1 Setpoint
      - Limsw 1 Act Direction
      - Limsw 1 Hysteresis
      - Limsw 1 Unit
    - Limit Switch 2 Set
      - Limit Switch 2 Value D
        - Status
        - Value
      - Limsw 2 Target
      - Limsw 2 Setpoint
      - Limsw 2 Act Direction
      - Limsw 2 Hysteresis
      - Limsw 2 Unit
  - Diagnostics/Alerts
    - Block Error
    - Transducer Error
    - Alarm Perform
    - Block Alarm
      - Unacknowledged
      - Alarm State
      - Time Stamp
      - Subcode
      - Value
    - Alarm Summary
      - Current
      - Unacknowledged
      - Unreported
      - Disabled
    - Update Event
      - Unacknowledged
      - Update State
      - Time Stamp
      - Static Rev
      - Relative Index
  - Query Device
    - TB Profile Parameters
    - TB Original Parameters(part1)
    - TB Original Parameters(part2)
    - TB Original Parameters(part3)
    - TB Original Parameters(part4)
    - TB Service Parameters

FA0902.ai

Note: Parameter name may differ according to a tool or host.

(3) AI1 Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Field Value
      - Status
      - Value
    - Process Value
      - Status
      - Value
    - Output
      - Status
      - Value
    - Total
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Channel
    - Transducer Scale
      - EU at 100%
      - EU at 0%
      - Units Index
      - Decimal
    - Output Scale
      - EU at 100%
      - EU at 0%
      - Units Index
      - Decimal
    - Process Value Filter Time
    - Options
      - Linearization Type
      - Low Cutoff
      - I/O Options
      - Status Options
    - Total Setup
      - Total Start
      - Total Rate Value
      - Total Reset
- Diagnostics/Alerts
  - Block Error
  - Alert Parameters
    - Block Almarm
      - Unacknowledged
      - Alarm State
      - Time Stamp
      - Subcode
      - Value
    - Alarm Summary
      - Current
      - Unacknowledged
      - Unreported
      - Disabled
    - Acknowledge Option
    - Alarm Hysteresis
    - High High Alarm Set
      - High High Priority
      - High High Limit
      - High High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - High Alarm Set
      - High Priority
      - High Limit
      - High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Low Alarm Set
      - Low Priority
      - Low Limit
      - Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Low Low Alarm Set
      - Low Low Priority
      - Low Low Limit
      - Low Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Update Event
      - Unacknowledged
      - Update State
      - Time Stamp
      - Static Rev
      - Index
- Others
  - Simulation Enable
  - Simulation Disable
  - Grant Deny
    - Grant
    - Deny
- Query Device
  - AI Standard parameters

FA0903.ai

Note: Parameter name may differ according to a tool or host.

(4) AI2 Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Field Value
      - Status
      - Value
    - Process Value
      - Status
      - Value
    - Output
      - Status
      - Value
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Channel
    - Transducer Scale
      - EU at 100%
      - EU at 0%
      - Units Index
      - Decimal
    - Output Scale
      - EU at 100%
      - EU at 0%
      - Units Index
      - Decimal
    - Process Value Filter Time
    - Options
      - Linearization Type
      - Low Cutoff
      - I/O Options
      - Status Options
- Diagnostics/Alerts
  - Block Error
  - Alert Parameters
    - Block Almarm
      - Unacknowledged
      - Alarm State
      - Time Stamp
      - Subcode
      - Value
    - Alarm Summary
      - Current
      - Unacknowledged
      - Unreported
      - Disabled
    - Acknowledge Option
    - Alarm Hysteresis
    - High High Alarm Set
      - High High Priority
      - High High Limit
      - High High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - High Alarm Set
      - High Priority
      - High Limit
      - High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Low Alarm Set
      - Low Priorit
      - Low Limit
      - Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Low Low Alarm Set
      - Low Low Priorit
      - Low Low Limit
      - Low Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Update Event
      - Unacknowledged
      - Update State
      - Time Stamp
      - Static Rev
      - Index
- Others
  - Simulation Enable
  - Simulation Disable
  - Grant Deny
    - Grant
    - Deny
- Query Device
  - AI Standard parameters

FA0904.ai

Note: Parameter name may differ according to a tool or host.

(5) AI3 Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Field Value
      - Status
      - Value
    - Process Value
      - Status
      - Value
    - Output
      - Status
      - Value
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Channel
    - Transducer Scale
      - EU at 100%
      - EU at 0%
      - Units Index
      - Decimal
    - Output Scale
      - EU at 100%
      - EU at 0%
      - Units Index
      - Decimal
    - Process Value Filter Time
    - Options
      - Linearization Type
      - Low Cutoff
      - I/O Options
      - Status Options
- Diagnostics/Alerts
  - Block Error
  - Alert Parameters
    - Block Almarm
      - Unacknowledged
      - Alarm State
      - Time Stamp
      - Subcode
      - Value
    - Alarm Summary
      - Current
      - Unacknowledged
      - Unreported
      - Disabled
    - Acknowledge Option
    - Alarm Hysteresis
    - High High Alarm Set
      - High High Priority
      - High High Limit
      - High High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - High Alarm Set
      - High Priority
      - High Limit
      - High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Low Alarm Set
      - Low Priorit
      - Low Limit
      - Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Low Low Alarm Set
      - Low Low Priorit
      - Low Low Limit
      - Low Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Float Value
    - Update Event
      - Unacknowledged
      - Update State
      - Time Stamp
      - Static Rev
      - Index
- Others
  - Simulation Enable
  - Simulation Disable
  - Grant Deny
    - Grant
    - Deny
- Query Device
  - AI Standard parameters

FA0905.ai

Note: Parameter name may differ according to a tool or host.

(6) DI1 Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Field Value Discrete
      - Status
      - Value
    - Process Value Discrete
      - Status
      - Value
    - Output Discrete
      - Status
      - Value
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Channel
    - Process Value Filter Time
    - I/O Options
    - Status Options
  - Diagnostics/Alerts
    - Block Error
    - Alert Parameters
      - Block Almarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
      - Alarm Summary
        - Current
        - Unacknowledged
        - Unreported
        - Disabled
      - Acknowledge Option
      - Discrete Primary
      - Discrete Limit
      - Discrete Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
      - Update Event
        - Unacknowledged
        - Update State
        - Time Stamp
        - Static Rev
        - Index
  - Others
    - Simulate Discrete
    - Grant Deny
      - Grant
      - Deny
  - Query Device
    - Standard parameters

(7) DI2 Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Field Value Discrete
      - Status
      - Value
    - Process Value Discrete
      - Status
      - Value
    - Output Discrete
      - Status
      - Value
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Channel
    - Process Value Filter Time
    - I/O Options
    - Status Options
  - Diagnostics/Alerts
    - Block Error
    - Alert Parameters
      - Block Almarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
      - Alarm Summary
        - Current
        - Unacknowledged
        - Unreported
        - Disabled
      - Acknowledge Option
      - Discrete Primary
      - Discrete Limit
      - Discrete Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
      - Update Event
        - Unacknowledged
        - Update State
        - Time Stamp
        - Static Rev
        - Index
  - Others
    - Simulate Discrete
    - Grant Deny
      - Grant
      - Deny
  - Query Device
    - Standard parameters

FA0906.ai

Note: Parameter name may differ according to a tool or host.

(8) IT Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Input 1
      - Status
      - Value
    - Input 2
      - Status
      - Value
    - Output
      - Status
      - Value
    - Reset/Reverse Inputs
      - Reset Input
        - Status
        - Value
      - Reset Confirm
        - Status
        - Value
      - Reverse Flow1
        - Status
        - Value
      - Reverse Flow2
        - Status
        - Value
    - Trip Outputs
      - Output Trip
        - Status
        - Value
      - Output Pre-Trip
        - Status
        - Value
    - Total/Snapshots
      - Snapshot of Total
      - Snapshot of Rejected Total
      - Snapshot of Setpoint
      - Accumulate Total
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Operator Command Integration
    - Basic Settings
      - Integration Type
      - Total Setpoint
      - Pre Trip
      - Clock Period
    - Unit/Conversions
      - Time Unit1
      - Time Unit2
      - Unit Conversion
      - Pulse Val1
      - Pulse Val2
    - Scaling/Limits
      - Good Limit
      - Uncertain Limit
      - Outage Limit
      - Output Range
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
    - Options
      - Integration Options
      - Status Options
  - Diagnostics/Alerts
    - Block Error
    - Number of Reset
    - Rejected Total
    - Percentage Included
    - Alert Parameters
      - Block Alarm
        - Unacknowledged
        - State
        - Time Stamp
        - Subcode
        - Value
      - Update Event
        - Unacknowledged
        - Update State
        - Time Stamp
        - Static Rev
        - Relative Index
  - Others
    - Grant Deny
      - Grant
      - Deny
  - Query Device
    - IT Standard parameters

FA0907.ai

Note: Parameter name may differ according to a tool or host.

(9) AR Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Inputs
      - Input
        - Status
        - Value
      - Input Low
        - Status
        - Value
      - Input 1
        - Status
        - Value
      - Input 2
        - Status
        - Value
      - Input 3
        - Status
        - Value
    - Output
      - Status
      - Value
    - Process Value
      - Status
      - Value
    - Pre Output
      - Status
      - Value
    - Density Factor
      - Status
      - Value
      - Density Factor Unit
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Input Parameters
      - Range Extension
        - Range High
        - Range Low
      - Bias/Gain
        - Bias Input 1
        - Gain Input 1
        - Bias Input 2
        - Gain Input 2
        - Bias Input 3
        - Gain Input 3
      - Input Options
      - Process Value Scale
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
    - Algorithm Parameters
      - Arithmetic Type
      - Compensation High Limit
      - Compensation Low Limit
    - Output Parameters
      - Balance Time
      - Bias
      - Gain
      - Output High Limit
      - Output Low Limit
      - Output Range
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
    - Density Factor Parameters
      - Density Factor Setup Wizard
      - Volumetric Flow Unit
      - Temperature Set
        - Temperature Unit
        - Base Temperature
      - Pressure Set
        - Pressure Unit
        - Base Pressure Abs.
      - Density Set
        - Density Unit
        - Base Density
      - Other Value Set
        - Deviation
        - First Temperature Coef.
        - Second Temperature Coef.
      - Flow Configuration Coef.
      - Maintenance Info
        - Configuration Soft Revision
        - Configuration Date
        - Configuration Who
        - Configuration Status
        - Configuration Memo 1
        - Configuration Memo 2
        - Configuration Memo 3
        - Configuration Setting Info
- Diagnostics/Alerts
  - Block Error
  - Alert Parameters
    - Block Alarm
      - Unacknowledged
      - State
      - Time Stamp
      - Subcode
      - Value
    - Update Event
      - Unacknowledged
      - Update State
      - Time Stamp
      - Static Rev
      - Relative Index
- Others
  - Grant Deny
    - Grant
    - Deny
- Query Device
  - AR Standard parameters
  - AR Enhanced parameters

FA0908.ai

Note: Parameter name may differ according to a tool or host.

(10) PID Function Block

- Menus
  - Block Info
    - Block Tag
    - Tag Description
    - Strategy
    - Alert Key
  - Block Mode
    - Target
    - Actual
    - Permitted
    - Normal
  - Dynamic Variables
    - Cascade Input
      - Status
      - Value
    - Setpoint
      - Status
      - Value
    - Input
      - Status
      - Value
    - Process Value
      - Status
      - Value
    - Output
      - Status
      - Value
    - Back Calculation Input
      - Status
      - Value
    - Back Calculation Output
      - Status
      - Value
    - Remote I/O
      - Remote Cascade Input
        - Status
        - Value
      - Remote Out Input
        - Status
        - Value
      - Remote Cascade Output
        - Status
        - Value
      - Remote Out Output
        - Status
        - Value
    - Others
      - Feed Forward Value
        - Status
        - Value
      - Tracking Value
        - Status
        - Value
      - Tracking Input Discrete
        - Status
        - Value
  - Configuration
    - Block Mode
      - Target
      - Actual
      - Permitted
      - Normal
    - Scaling/Filter/Limits
      - Process Value Scale
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
      - Output Scale
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
      - Setpoint Rate Down
      - Setpoint Rate Up
      - Process Value Filter Time
      - Setpoint High Limit
      - Setpoint Low Limit
      - Output High Limit
      - Output Low Limit
    - Control Parameters
      - Gain
      - Reset
      - Rate
      - Bypass
      - Balance Time
    - Feed Forward Control
      - Feed Forward Scale
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
      - Feed Forward Gain
    - Tracking
      - Tracking Scale
        - EU at 100%
        - EU at 0%
        - Units Index
        - Decimal
    - Options
      - Control Options
      - Status Options
      - Shed Options
      - Back Calculation Hysteresis
- Diagnostics/Alerts
  - Block Error
  - Alert Parameters
    - Block Alarm
      - Unacknowledged
      - Alarm State
      - Time Stamp
      - Subcode
      - Value
    - Alarm Summary
      - Current
      - Unacknowledged
      - Unreported
      - Disabled
    - Acknowledge Option
    - Alarm Hysteresis
    - High High Alarm Set
      - High High Priority
      - High High Limit
      - High High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
    - High Alarm Set
      - High Priority
      - High Limit
      - High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
    - Low Alarm Set
      - Low Priority
      - Low Limit
      - Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
    - Low Low Alarm Set
      - Low Low Priority
      - Low Low Limit
      - Low Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
    - Deviation High Alarm Set
      - Deviation High Priority
      - Deviation High Limit
      - Deviation High Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
    - Deviation Low Alarm Set
      - Deviation Low Priority
      - Deviation Low Limit
      - Deviation Low Alarm
        - Unacknowledged
        - Alarm State
        - Time Stamp
        - Subcode
        - Value
    - Update Event
      - Unacknowledged
      - Alarm State
      - Time Stamp
      - Subcode
      - Value
- Others
  - Grant Deny
    - Grant
    - Deny
- Query Device
  - Standard parameters

FA0909.ai

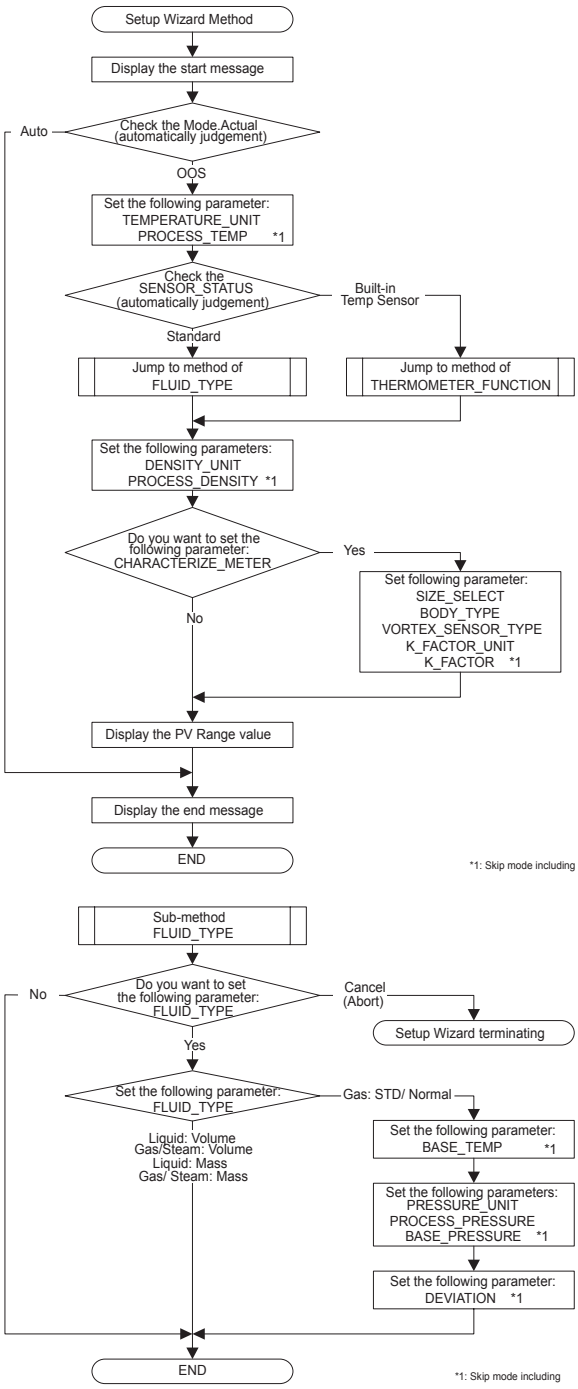
Note: Parameter name may differ according to a tool or host.

APPENDIX 10. METHOD

A10.1 Transducer Block

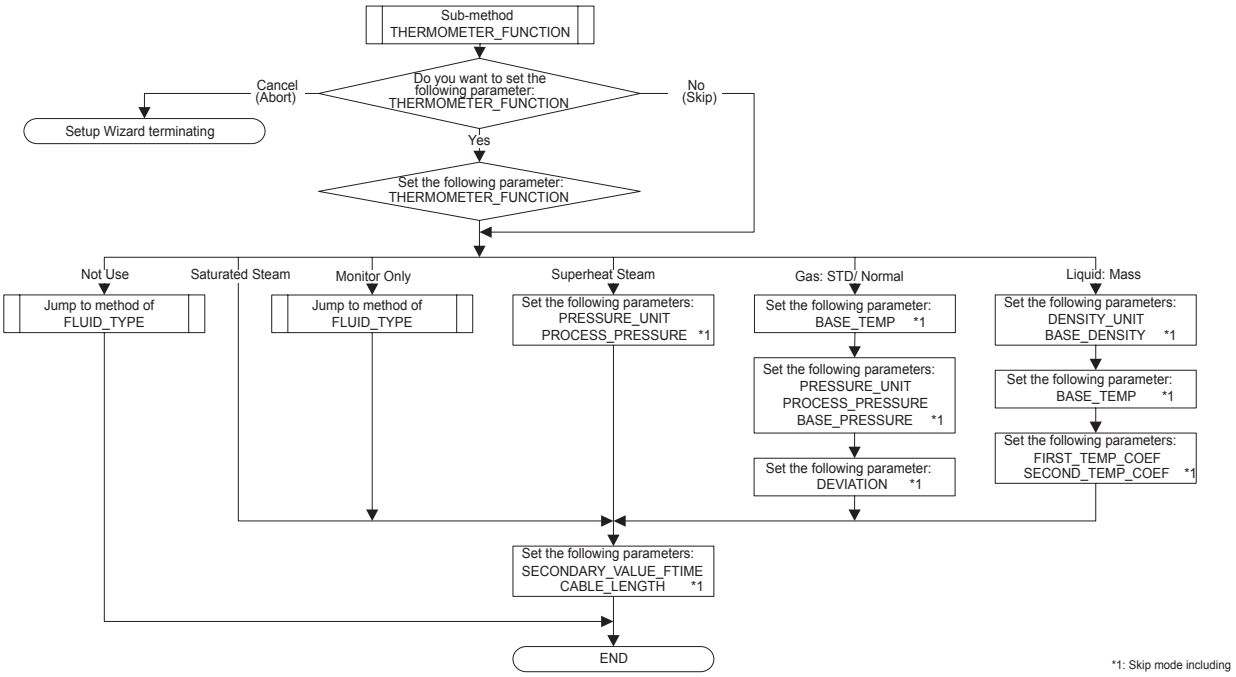
METHOD is a program to facilitate the parameter settings.
Set TR block to “O/S”, for parameter setting by METHOD.

(1) Setup Wizard Method

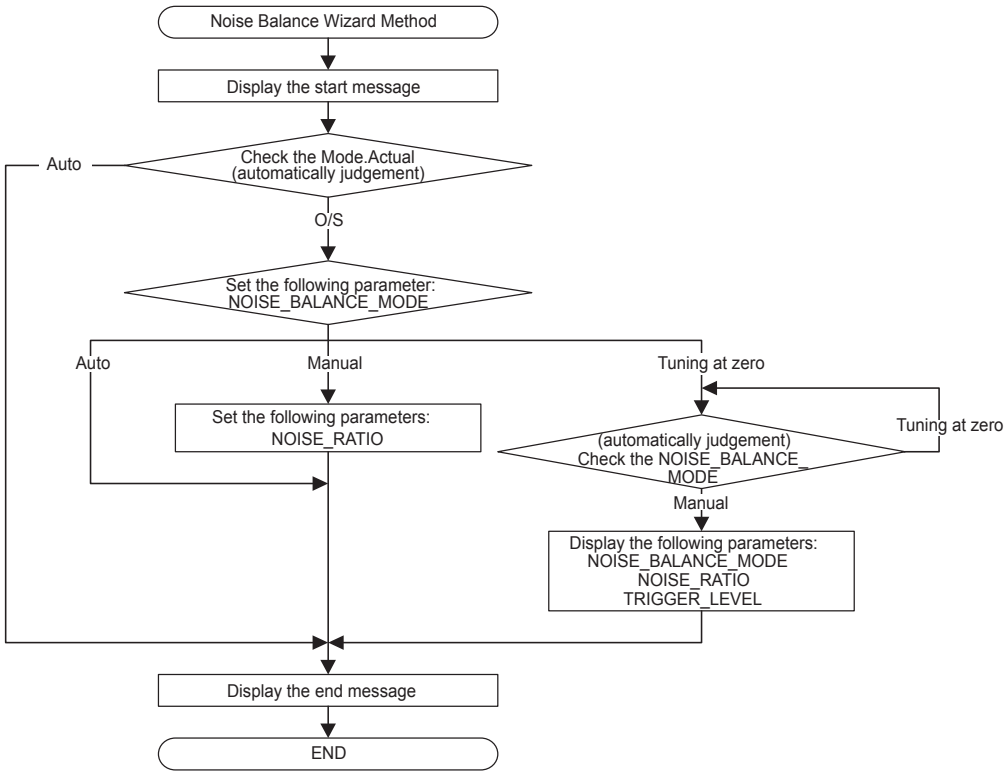


FA1001.ai

(1) Continued

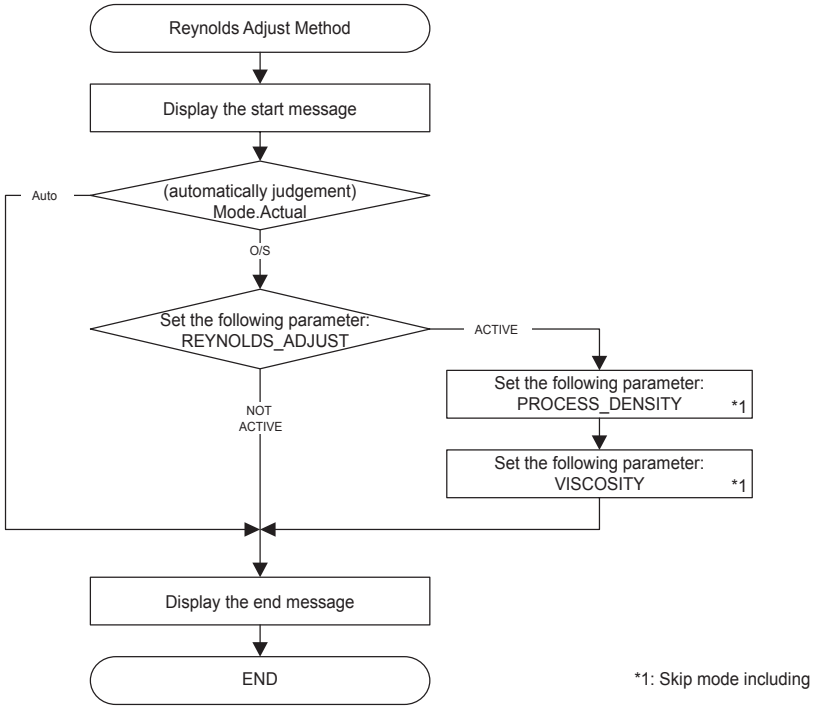

Sub-method
THERMOMETER_FUNCTION
Do you want to set the following parameter: THERMOMETER_FUNCTION
Cancel (Abort)
Setup Wizard terminating
No (Skip)
Yes
Set the following parameter: THERMOMETER_FUNCTION
Not Use
Saturated Steam
Monitor Only
Superheat Steam
Gas: STD/ Normal
Liquid: Mass
Jump to method of FLUID_TYPE
Jump to method of FLUID_TYPE
Set the following parameters: PRESSURE_UNIT PROCESS_PRESSURE *1
Set the following parameter: BASE_TEMP *1
Set the following parameters: PRESSURE_UNIT PROCESS_PRESSURE BASE_PRESSURE *1
Set the following parameter: DEVIATION *1
Set the following parameters: DENSITY_UNIT BASE_DENSITY *1
Set the following parameter: BASE_TEMP *1
Set the following parameters: FIRST_TEMP_COEF SECOND_TEMP_COEF *1
Set the following parameters: SECONDARY_VALUE_FTIME CABLE_LENGTH *1
END
*1: Skip mode including
FA1002.ai

(2) Noise Balance Wizard Method



FA1003.ai

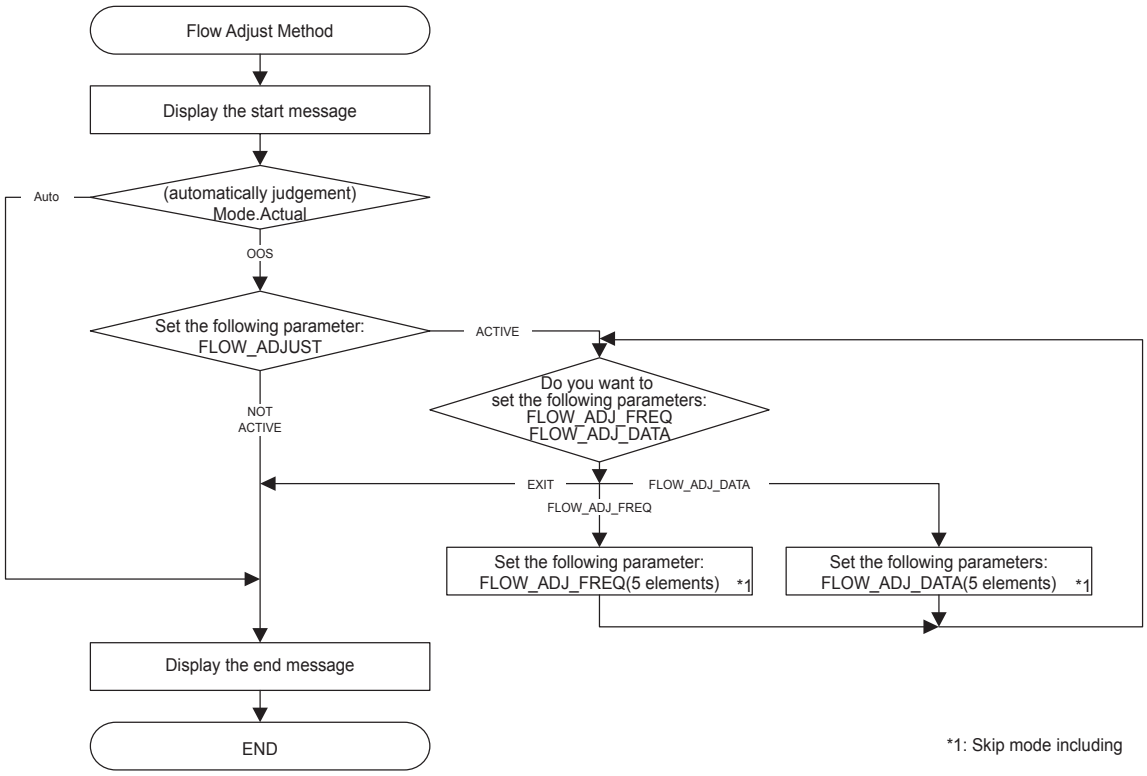
(3) Reynolds Adjust Method



*1: Skip mode including

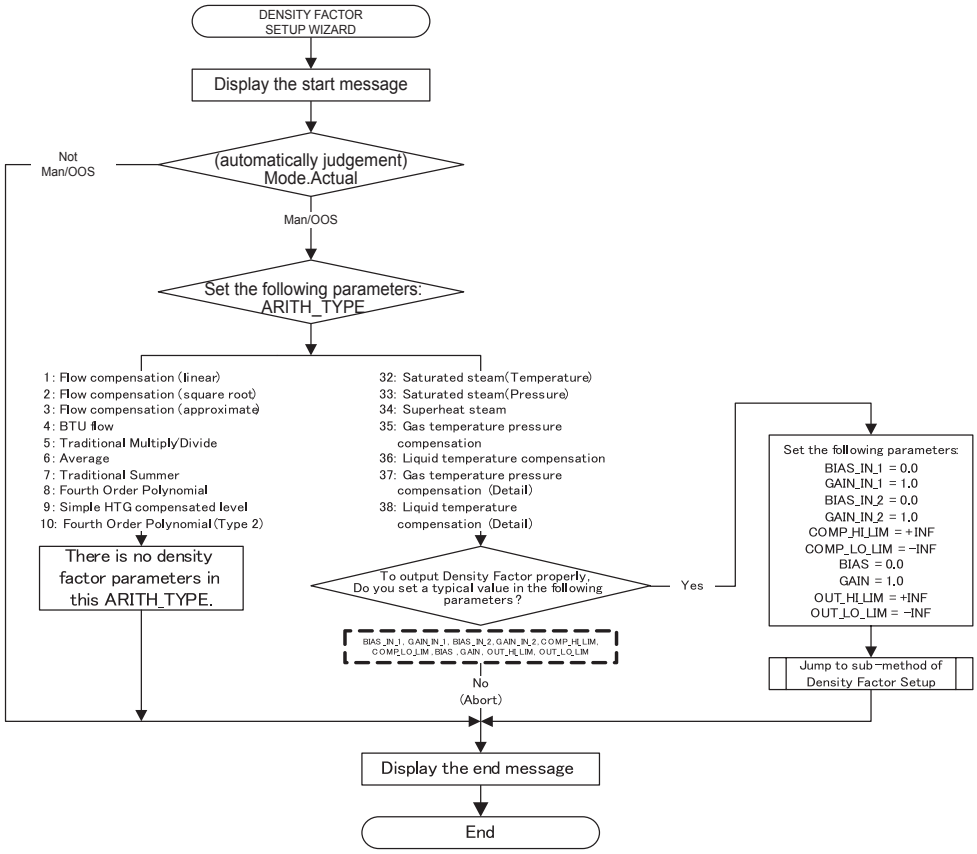
FA1004.ai

(4) Flow Adjust Method



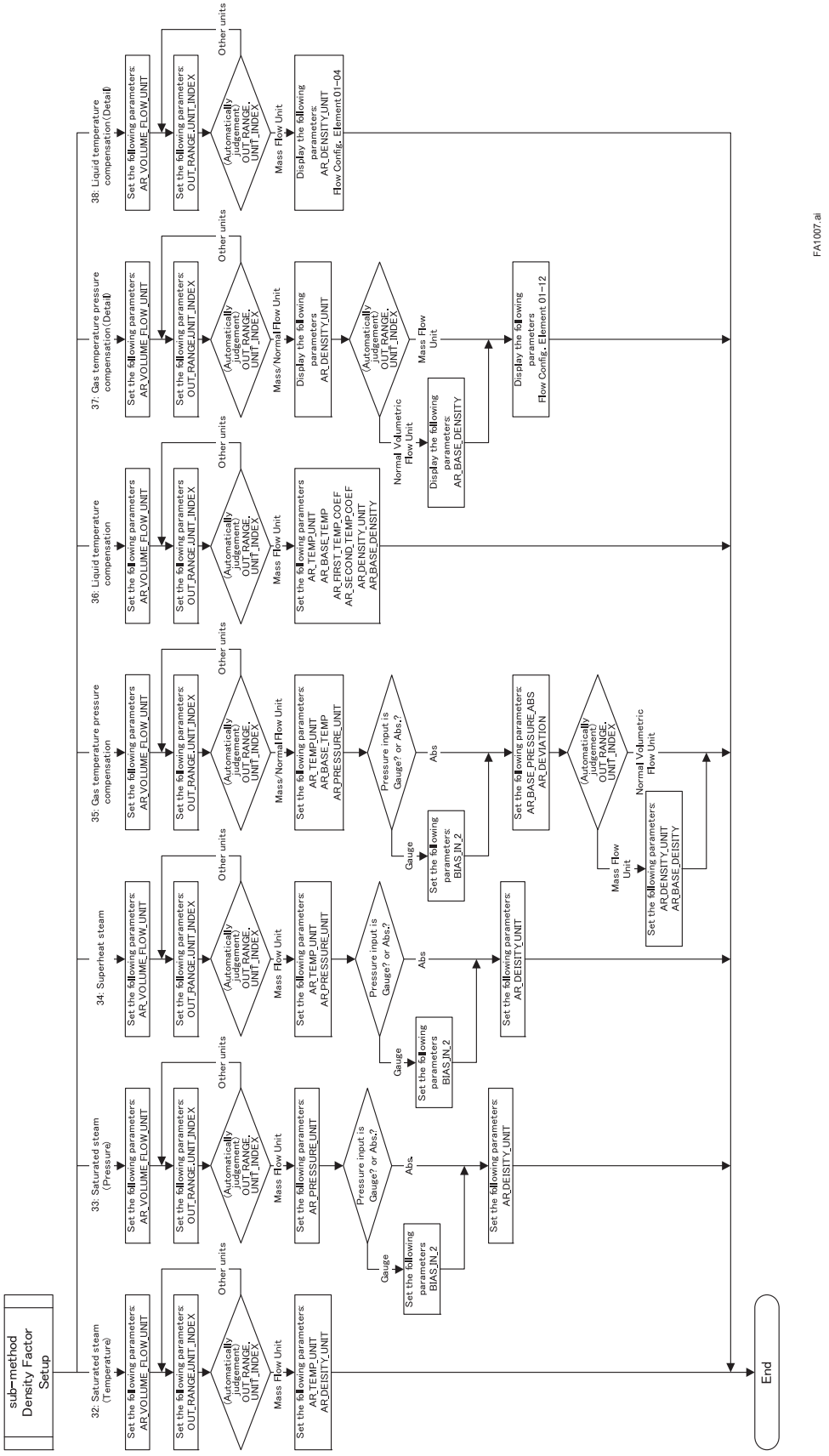
A10.2 Enhanced AR Block

(1) Density Factor Setup Wizard

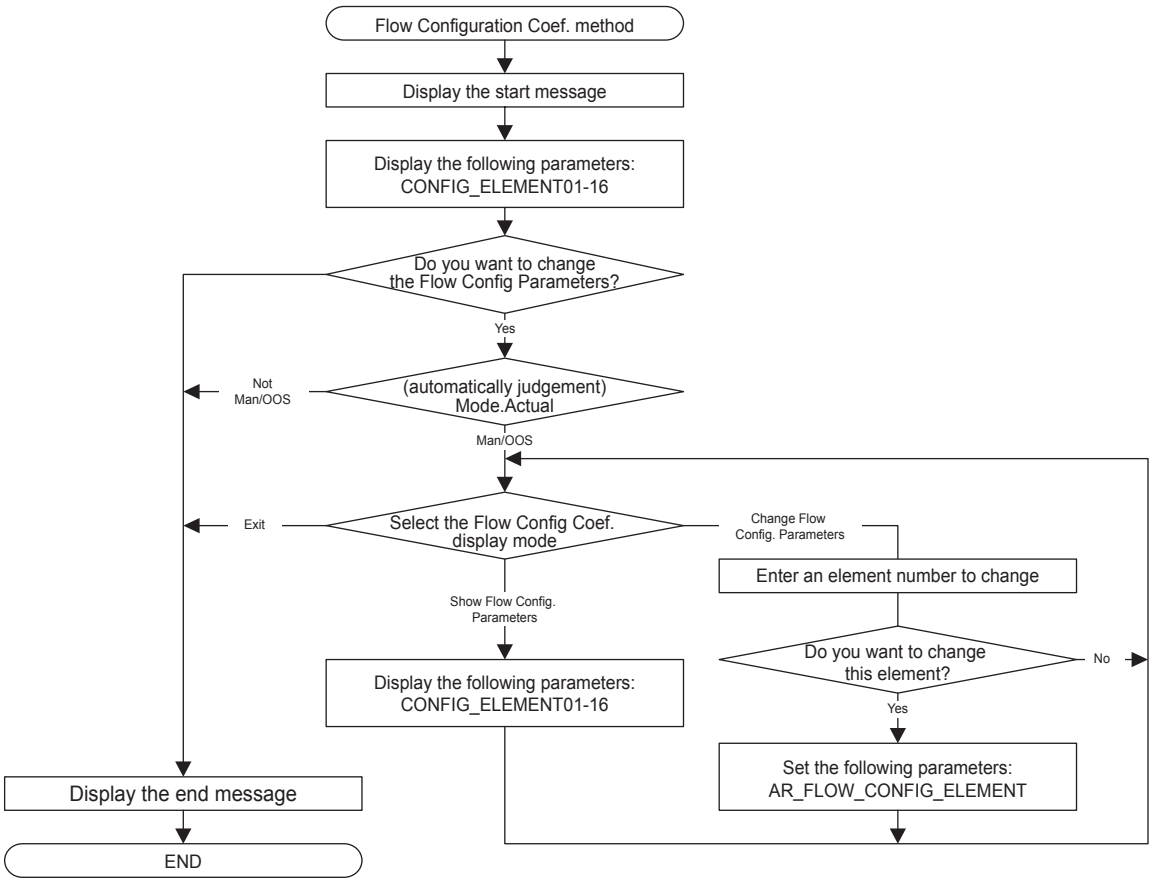


FA1006.ai

(1) Continued

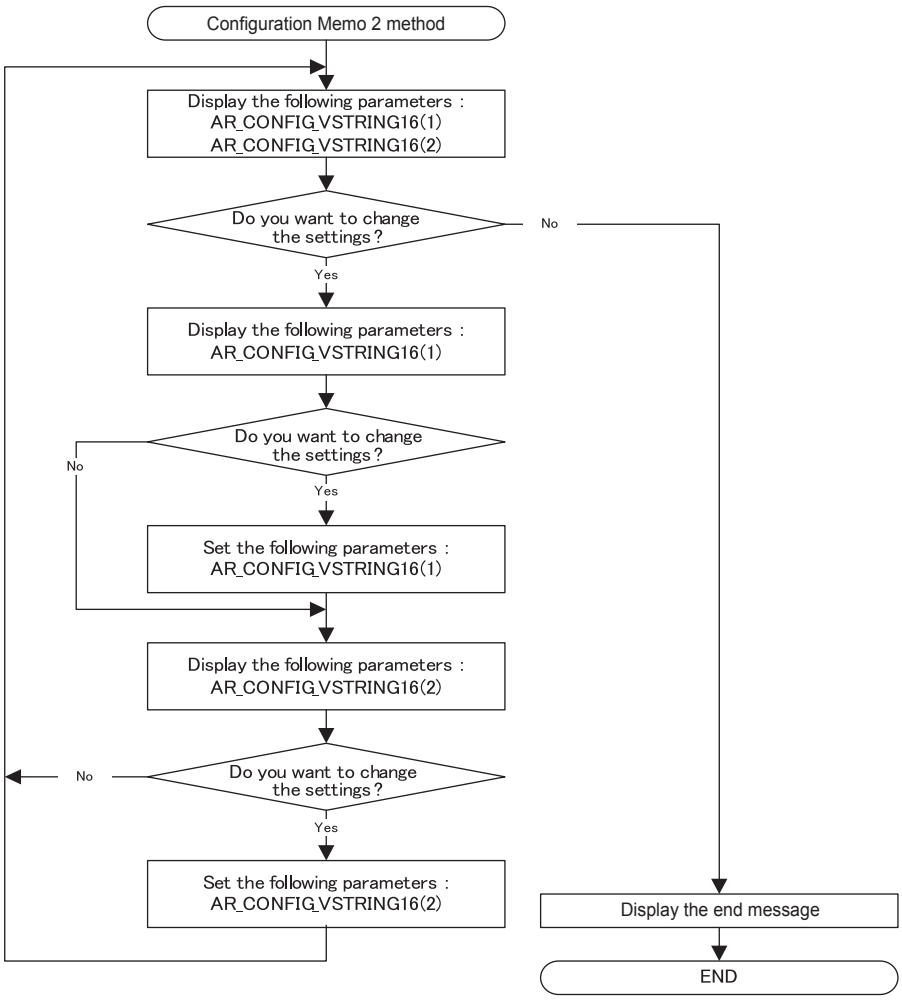

sub-method
Density Factor Setup
32: Saturated steam (Temperature)
33: Saturated steam (Pressure)
34: Superheat steam
35: Gas temperature pressure compensation
36: Liquid temperature compensation
37: Gas temperature pressure compensation (Detail)
38: Liquid temperature compensation (Detail)
Set the following parameters: AR_VOLUME_FLOW_UNIT
Set the following parameters: OUT_RANGE_UNIT_INDEX
(Automatically judgement) OUT_RANGE_UNIT_INDEX
Other units
Mass Flow Unit
Set the following parameters: AR_TEMP_UNIT AR_DEISITY_UNIT
Set the following parameters: AR_PRESSURE_UNIT
Pressure input is Gauge? or Abs.?
Gauge
Abs
Set the following parameters: BIAS_IN_2
Set the following parameters: AR_DEISITY_UNIT
Mass/Normal Flow Unit
Set the following parameters: AR_TEMP_UNIT AR_BASE_TEMP AR_PRESSURE_UNIT
Set the following parameters: AR_BASE_PRESSURE_ABS AR_DEVIATION
Normal Volumetric Flow Unit
Set the following parameters: AR_DENSITY_UNIT AR_BASE_DEISITY
Set the following parameters: AR_TEMP_UNIT AR_BASE_TEMP AR_FIRST_TEMP_COEF AR_SECOND_TEMP_COEF AR_DENSITY_UNIT AR_BASE_DENSITY
Display the following parameters: AR_BASE_DENSITY
Display the following parameters: AR_DENSITY_UNIT
Display the following parameters Flow Config., Element 01–12
Display the following parameters: AR_DENSITY_UNIT Flow Config., Element 01–04
End
FA1007.ai

(2) Flow Configuration Method



FA1008.ai

(3) Configuration Memo 2 Method



FA1009.ai

APPENDIX 11. SOFTWARE DOWNLOAD (Option /EE)

A11.1 Benefits of Software Download

This function enables you to download software to field devices via a FOUNDATION Fieldbus to update their software.
Typical uses are to add new features such as function blocks to existing devices, and to optimize existing field devices for your plant.

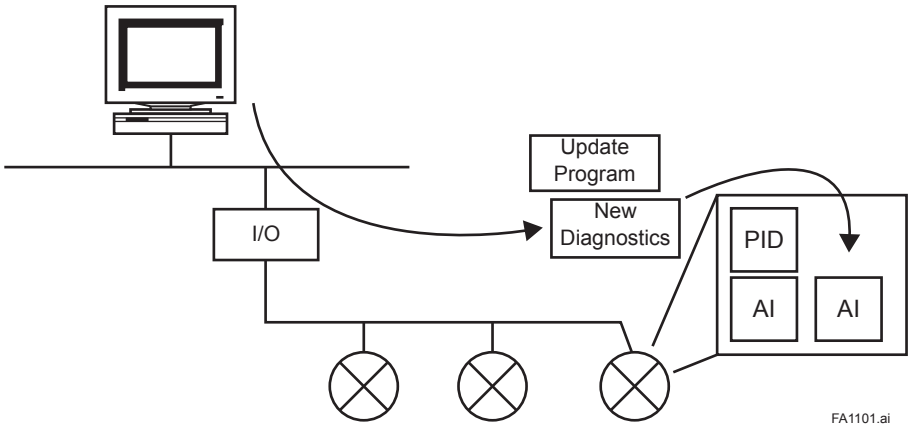


Figure A11.1 Concept of Software Downloading

A11.2 Specifications

Current Draw (Steady-state): 15mA (max)
Current Draw (Software Download state): 24mA (max)
Current during FlashROM blanking time:
Max. 24 mA additional to steady-state current
Based on Fieldbus Foundation Specification
Download class: Class 1

NOTE

Class 1 devices can continue the specified measurement and/or control actions even while software is being downloaded to them. Upon completion of a download, however, the devices will be reset internally to make the new, downloaded software take effect, and this will halt fieldbus communication and function block executions for about one minute.

A11.3 Preparations for Software Downloading

For software downloading, you need to prepare the following:

- Software download tool
- Software for downloading file for each of the target field devices

For the software download tool, use only a program developed for that purpose. For details, see the software's User's Manual. For information about updates of software binary files for field devices and how to obtain them, visit the following web site.
http://www.yokogawa.com/fld/

CAUTION

Do not hook up the software download tool to a fieldbus segment while the plant is in operation, as it may temporarily disturb the communication. Always connect the tool before starting operation.

NOTE

The download tool can not execute downloading during other system connects to the system/ network management VFD of the device.

A11.4 Software Download Sequence

The flowchart below outlines the software download procedure. Although the time taken for the entire procedure varies depending on the size of the field bus device's software, it generally take about 20 minutes where there is a one-to-one connection between a fieldbus device and download tool, and longer when multiple field devices are connected to the fieldbus.

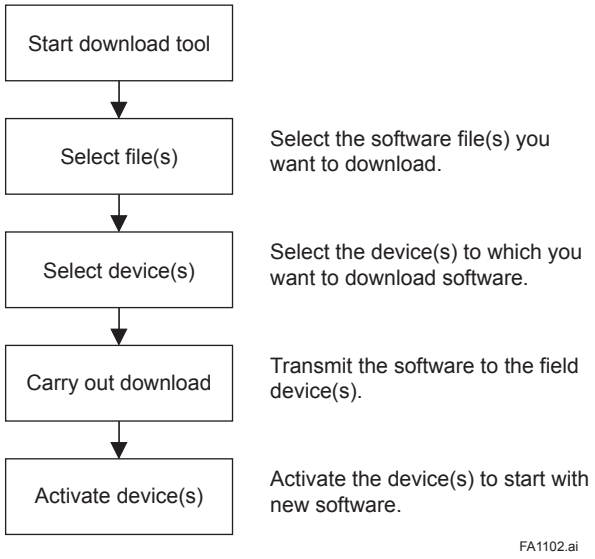


Figure A11.2 Flow of Software Download Procedure

CAUTION

Carrying out a software download leaves the PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device, but may reset other parameters to the defaults (except a minor update that does not change the number of parameters). Hence, where necessary, save the parameters using an engineering tool, parameter setting utility, or the like before carrying out a software download, and then reconfigure the field device(s) after the download. For details, refer to APPENDIX 11.6 "Steps after Activating a Field Device."

CAUTION

The current dissipation of the target field device increases transitorily immediately after a download due to erasing of the FlashROM's contents. Use a fieldbus power supply which has sufficient capacity to cover such increases in feed current.

CAUTION

Upon completion of the activation, the target fieldbus device performs resetting internally, which temporarily halts fieldbus communication and function block executions. Be especially careful about a valve positioner; the output air pressure will fall to the minimum level (i.e., zero).

CAUTION

Do not turn off the power to a field device or disconnect the download tool during a download or activation. The device may fail as a result.

NOTE

Be careful about the noise on the fieldbus link. If the fieldbus is noisy, the downloading may take a very long time or fail.

A11.5 Download Files

Download files have the following filenames (with the filename extension of ".ffd"). Take care to choose the correct download file for the target field device:

"594543" + device family + "_" + device type + "_" + domain name + "_" + software name + "_" + software revision + ".ffd"

For example, the name of the download file for the DYF. may have the following name:

5945430009_0009_DYF.-SD_ORIGINAL_R202.ffd

The device type is “0009” for the digitalYEWFLO.
The software name is “ORIGINAL” or “UPDATE.”
The former indicates an original file and the latter an update file. Whenever performing a download to update the device revision, obtain the original file.
In general, an addition to the parameters or blocks requires a device revision update.

A11.6 Steps after Activating a Field Device

When the communication with a field device has recovered after activating the device, check using the download tool that the software revision of the field device has been updated accordingly. The value of SOFT_REV of the resource block indicates the software revision.
The PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device will remain unchanged after a software download.
However, after a software update which causes an addition to the block parameters or blocks, or to the system/network management VFD parameters, some parameters may be reset to the defaults, thus requiring parameter setup and engineering again.
For details, refer to Table A11.1.
Also note that a change in the number of parameters or blocks requires the DD and capabilities files corresponding to the new software revision.

Table A11.1 Actions after Software Update

Contents of Software Update	Action
Does not change the number of parameters.	Re-setup of parameters not needed.
Adds a block parameter.	Setup of the added parameter needed.
Adds a block.	Reengineering and setup of the added block’s parameters needed.
Changes the number of system/network management VFD parameters.	Reengineering needed.

A11.7 Troubleshooting

For information on the download tool's error messages, see also the software's User's Manual.

Table A11.2 Problems after Software Update

Symptom	Cause	Remedy
An error occurs before starting a download, disabling the download.	The selected download file is not for the selected field device.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
An error occurs after starting a download, disabling the download.	You attempted to update the device revision by downloading a file which is not an original file.	Check SOFTDWN_ERROR in the resource block and obtain the original file.
	The selected field device does not support software downloading.	Check whether the option code /EE is included in the model and suffix codes of the device.
	The voltage on the fieldbus segment falls below the specified limit (9 volts).	Check the capacity of the field bus power supply used and the voltage at the terminal.
	There was an error in a checksum or the number of transmission bytes.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
	The download tool does not allow download with same software revision.	Check the setting of the download tool.
The download takes far longer than expected or fails frequently.	The fieldbus segment is noisy.	Check the noise level on the fieldbus segment.
An error occurs after activation.	Transient error caused by the internal resetting of the field device	Check whether communication with the field device has recovered after a while.
The new software does not work after the activation.	The file of the current revision was downloaded.	Obtain the correct file.
	Failure of the memory in field device, etc.	Check SOFTDWN_ERROR in the resource block, and re-try downloading. If fails, place a service call.

A11.8 Resource Block's Parameters Relating to Software Download

Table A11.3 Additional Parameters of Resource Block

Relative Index	Index	Parameter Name	Default (Factory Set)	Write Mode	Description
53	1053	SOFTDWN_ PROTECT	0x01	AUTO	Defines whether to accept software downloads. 0x01: Unprotected 0x02: Protected
54	1054	SOFTDWN_ FORMAT	0x01	AUTO	Selects the software download method. 0x01: Standard
55	1055	SOFTDWN_COUNT	0	—	Indicates the number of times the internal FlashROM was erased.
56	1056	SOFTDWN_ACT_ AREA	0	—	Indicates the ROM number of the currently working FlashROM. 0: FlashROM #0 working 1: FlashROM #1 working
57	1057	SOFTDWN_MOD_ REV	1, 0, 0, 0, 0, 0, 0, 0, 0	—	Indicates the software module revision.
58	1058	SOFTDWN_ERROR	0	—	Indicates an error during a software download. Refer to Table A11.4 for error codes.

Table A11.4 Download Error Codes

Error Code	Detail
0	No error
32768	Unsupported header version
32769	Abnormal header size
32770	Abnormal manufacturer ID
32771	Abnormal device family
32772	Abnormal device revision
32773	Abnormal vendor specification version
32774	Abnormal number of modules
32775	Abnormal number of bytes in module 1
32776	Abnormal number of bytes in module 2
32777	Device error in module 1
32778	Checksum error in module 1
32779	Checksum error in file
32780	Unused
32781	Write-prohibited area in FlashROM
32782	Verification error during FlashROM writing
32783	Polling error during FlashROM erasing
32784	Polling time-out during FlashROM erasing
32785	Polling error during FlashROM writing
32786	Polling time-out during FlashROM writing
32787	FlashROM driver undefined number error
32788	File endcode error
32789	File type error (UPDATE, ORIGINAL)
32790	FlashROM driver undefined number error
32791	On-start state error (other than DWNLD_NOT_READY)
32792	Start segment error in module 1
32793	Binary file error
32794	Binary file error
32795	Device error in module 2
32796	Detection of EEPROM state other than backup after activation
32797	Checksum error in module 2
32798	Not in DWNLD_READY state when receiving GenericDomainInitiate
32799	Not in DWNLD_OK state when receiving GenericDomainTerminate
32800	Not in DOWNLOADING state when receiving GenericDomainSegment
32801	Firmware error
36863	Unused

A11.9 System/Network Management VFD Parameters Relating to Software Download

A11.9.1 Parameter List

Table A11.5 System/Network Management VFD Parameters

Write Mode: R/W = read/write; R = read only

Index (SM)	Parameter Name	Sub Index	Sub-parameter Name	Default (Factory Set)	Write Mode	Remarks
400	DWNLD_PROPERTY	0			R	
		1	Download Class	1		
		2	Write Rsp Returned For ACTIVATE	1		
		3	Write Rsp Returned For PREPARE	1		
		4	Reserved	0		
		5	ReadyForDwnld Delay Secs	300		
		6	Activation Delay Secs	60		
410	DOMAIN_DESCRIPTOR	0			R/W	Read/write-permitted only for sub-index 1
		1	Command	3		
		2	State	1		
		3	Error Code	0		
		4	Download Domain Index	440		
		5	Download Domain Header Index	420		
		6	Activated Domain Header Index	430		
		7	Domain Name	(Device name)		
420	DOMAIN_HEADER.1	0				
		1	Header Version Number	0		
		2	Header Size	0		
		3	Manufacturer ID			
		4	Device Family			
		5	Device Type			
		6	Device Revision	0		
		7	DD Revision	0		
		8	Software Revision			
		9	Software Name			
		10	Domain Name			
430	DOMAIN_HEADER.2	0				
		1	Header Version Number	1		
		2	Header Size	44		
		3	Manufacturer ID	0x594543		
		4	Device Family	(DEV_TYPE of RB)		
		5	Device Type	(DEV_TYPE of RB)		
		6	Device Revision	(DEV_REV of RB)		
		7	DD Revision	(DD_REV of RB)		
		8	Software Revision	(SOFT_REV of RB)		
		9	Software Name	ORIGINAL		
		10	Domain Name	(Device name)		
440	DOMAIN					Read/write: prohibited Get-OD: permitted

A11.9.2 Descriptions for Parameters

IMPORTANT

Do not turn off the power to a field device immediately after changing parameter settings. Data writing actions to the EEPROM are dual redundant to ensure reliability. If the power is turned off within 60 seconds after setup, the parameters may revert to the previous settings.

(1) DWNLD_PROPERTY

Sub Index	Element	Size (Bytes)	Description
1	Download Class	1	Indicates the download class. 1: Class 1
2	Write Rsp Returned For ACTIVATE	1	Indicates whether a write response is returned to the ACTIVATE command. 1: Write Response Returned
3	Write Rsp Returned For PREPARE	1	Indicates whether a write response is returned to the PREPARE command. 1: Write Response Returned
4	Reserved	1	(Reserved)
5	ReadyForDwnld Delay Secs	2	Indicates the maximum delay after receipt of the PREPARE_FOR_DWNLD command to proceed to transition from DWNLD_NOT_READY to DWNLD_READY.
6	Activation Delay Secs	2	Indicates the maximum delay after receipt of the ACTIVATE command to proceed to transition from DWNLD_OK to DWNLD_NOT_READY.

(2) DOMAIN_DESCRIPTOR

Sub Index	Element	Size (Bytes)	Description
1	Command	1	Reads/writes software download commands. 1: PREPARE_FOR_DWNLD (instruction of download preparation) 2: ACTIVATE (activation instruction) 3: CANCEL_DWNLD (instruction of download cancellation)
2	State	1	Indicates the current download status. 1: DWNLD_NOT_READY (download not ready) 2: DWNLD_PREPARING (download under preparation) 3: DWNLD_READY (ready for download) 4: DWNLD_OK (download complete) 5: DOWNLOADING (download underway) 6: CHECKSUM_FAIL (not used in this product) 7: FMS_DOWNLOAD_FAIL (failure during download) 8: DWNLD_INCOMPLETE (download error detected at restart) 9: VCR_FAIL (not used in this product) 10: OTHER (download error other than 6 and 7 detected)
3	Error Code	2	Indicates the error during a download and activation. 0: success, configuration retained (download successfully completed) 32768 - 65535: Download error (See Table 4 for error codes.)
4	Download Domain Index	4	Indicates the index number of the domain for software downloading.
5	Download Domain Header Index	4	Indicates the index number of the domain header to which the download is performing.
6	Activated Domain Header Index	4	Indicates the index numbers of the domain header currently running.
7	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

(3) DOMAIN_HEADER

Sub Index	Element	Size (Bytes)	Description
1	Header Version Number	2	Indicates the version number of the header.
2	Header Size	2	Indicates the header size.
3	Manufacturer ID	6	Indicates the value of resource block's MANUFAC_ID (manufacturer ID) as character string data.
4	Device Family	4	Indicates the device family. With this product, Device Family indicates the value of resource block's DEV_TYPE as character string data.
5	Device Type	4	Indicates the value of resource block's DEV_TYPE as character string data.
6	Device Revision	1	Indicates the value of resource block's DEV_REV.
7	DD Revision	1	Indicates the value of resource block's DD_REV.
8	Software Revision	8	Indicates the value of resource block's SOFT_REV.
9	Software Name	8	Indicates the attribute of the binary file. With this product, Software Name indicates either of the following: "ORIGINAL" followed by one space: Original file "UPDATE" followed by two spaces: Update file
10	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

APPENDIX 12. DEVICEVIEWER WINDOW EXECUTED FROM PRM (Plant Resource Manager)

With DeviceViewer, it is possible to display whether or not the hardware status and configuration are normal as the result of self-diagnosis performed by an FF-H1 device. (Please refer to IM 33Y05Q10-11E.)
The following figure shows an example of the DeviceViewer window displayed for the digitalYEWFLO module.

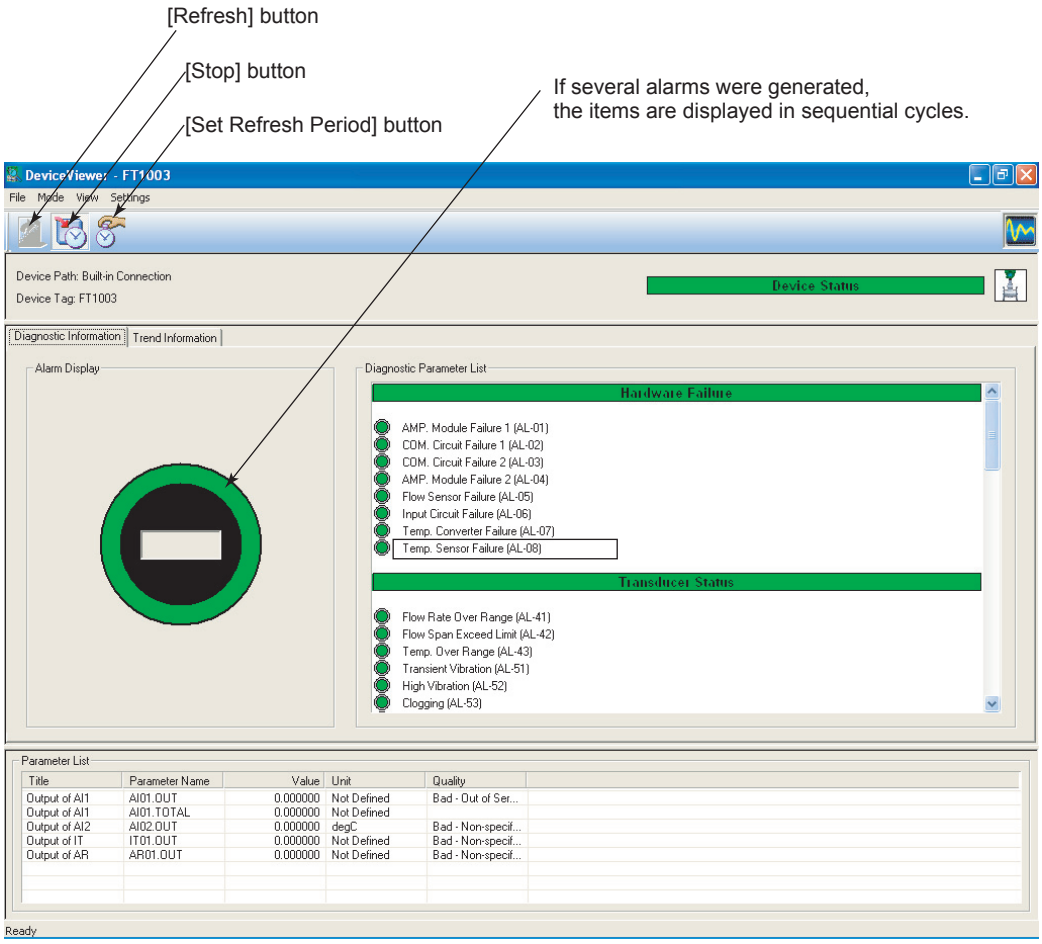


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Table A12.1 Hardware Failure

Alarm item	Alarm No.	Description	Parameter
AMP. Module Failure 1 (AL-01)	AL-01	The EEPROM(S) failed. (AL-01) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit0
COM. Circuit Failure 1 (AL-02)	AL-02	The serial communication circuit in the amplifier failed (type 1 error). (AL-02) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit1
COM. Circuit Failure 2 (AL-03)	AL-03	The serial communication circuit in the amplifier failed (type 2 error). (AL-03) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit2
AMP. Module Failure 2 (AL-04)	AL-04	The EEPROM(F) failed. (AL-04) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_1 bit19
Flow Sensor Failure (AL-05)	AL-05	The flow sensor failed. (AL-05) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit3
Input Circuit Failure (AL-06)	AL-06	The input circuit in the amplifier failed. (AL-06) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit4
Temp. Converter Failure (AL-07)	AL-07	The temperature circuit in the amplifier failed. (AL-07) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit5
Temp. Sensor Failure (AL-08)	AL-08	The temperature sensor failed. (AL-08) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_2 bit6

Table A12.2 Transducer Status

Alarm item	Alarm No.	Description	Parameter
Flow Rate Over Range (AL-41)	AL-41	Flow rate is over the range. (AL-41) [Remedy]: This case is out of specifications. Check the process flow.	RS DEVICE_ STATUS_4 bit7
Flow Span Exceed Limit (AL-42)	AL-42	The flow rate span setting exceeds the range limit. (AL-42) [Remedy]: Check the TB and AI1 parameters.	RS DEVICE_ STATUS_4 bit6
Temp. Over Range (AL-43)	AL-43	Temperature is over the range. (AL-43) (Regulated in the upper or lower limit value) [Remedy]: This case is out of specifications. Check the process temperature.	RS DEVICE_ STATUS_4 bit5
Transient Vibration (AL-51)	AL-51	The transient vibration makes the current flow rate output constant. (AL-51) [Remedy]: Check the pipeline condition. When this alarm occurs several time, contact the nearest office or service center.	RS DEVICE_ STATUS_4 bit3
High Vibration (AL-52)	AL-52	The high vibration makes the current flow rate output zero. (AL-52) [Remedy]: In case of outputting the current flow rate, Change the value of High vibration output select in TB Alarm Perform(TB.ALARM_PERFORM) to ON. When this alarm occurs several time, contact the nearest office or service center.	RS DEVICE_ STATUS_4 bit2
Clogging (AL-53)	AL-53	The shedder bar is clogged with a material. (AL-53) [Remedy]: Remove a material according to device manual (IM 01F06F00-01EN).	RS DEVICE_ STATUS_4 bit1
Fluctuating (AL-54)	AL-54	The current flow rate is fluctuating more than 20%. (AL-54) [Remedy]: Check the pipeline condition. When this alarm occurs several time, contact the nearest office or service center.	RS DEVICE_ STATUS_4 bit0
Indicator Over Range (AL-61)	AL-61	Indicator is over the range. (AL-61) [Remedy]: Check the value of AI1 Transducer Scale (AI1.XD_SCALE) or AI1 Output Scale (AI1.OUT_SCALE).	RS DEVICE_ STATUS_4 bit0
SoftDL Incomplete	-	Software download is incomplete. [Remedy]: Check the cables, power, and RB Softdown Error (RB.SOFTDOWN_ ERROR).	RS DEVICE_ STATUS_1 bit24
SoftDL Failure	-	Software download failed. [Remedy]: Check the download file and RB Softdown Error (RB.SOFTDOWN_ERROR).	RS DEVICE_ STATUS_1 bit25
Abnormal Boot Process	-	Abnormal boot processing was detected at the time of startig. [Remedy]: Check cable, power and RB.SOFTDWN_ERROR (RB.SOFTDOWN_ ERROR).	RS DEVICE_ STATUS_1 bit26

Table A12.3 Configuration(Mandatory)

Alarm item	Alarm No.	Description	Parameter
RB in O/S Mode (AL-21)	AL-21	Resource Block is in O/S mode. (AL-21) [Remedy]: Change the RB Block Mode. Target (RB.MODE_BLK.Target) to Auto mode.	RS DEVICE_ STATUS_1 bit22
TB in O/S Mode (AL-22)	AL-22	Transducer Block is in O/S mode. (AL-22) [Remedy]: Change the TB Block Mode. Target (TB.MODE_BLK.Target) to Auto mode.	RS DEVICE_ STATUS_3 bit25
AI1 in O/S Mode (AL-23)	AL-23	AI1 Block is in O/S mode. (AL-23) [Remedy]: Change the AI1 Block Mode. Target (AI1.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_3 bit24
AI1 in Man Mode (AL-62)	AL-62	AI1 Block is in Manual mode. (AL-62) [Remedy]: Change the AI1 Block Mode. Target (AI1.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_3 bit18
AI1 Simulation Active (AL-63)	AL-63	AI1 Block is in simulation mode. (AL-63) [Remedy]: Change the AI1 Simulation Enable/Disable (AI1.SIMULATE_ENABLE) to Disabled.	RS DEVICE_ STATUS_3 bit17
AI1 Not Scheduled (AL-64)	AL-64	AI1 Block is not scheduled. (AL-64) [Remedy]: Make a schedule of AI1 Block.	RS DEVICE_ STATUS_3 bit16

Table A12.4 Configuration(Optional)

Alarm item	Alarm No.	Description	Parameter
AI2 in O/S Mode (AL-24)	AL-24	AI2 Block is in O/S mode. (AL-24) [Remedy]: Change the AI2 Block Mode. Target (AI2.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_3 bit23
AI2 in Man Mode (AL-65)	AL-65	AI2 Block is in Manual mode. (AL-65) [Remedy]: Change the AI2 Block Mode. Target (AI2.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_3 bit14
AI2 Simulation Active (AL-66)	AL-66	AI2 Block is in simulation mode. (AL-66) [Remedy]: Change the AI2 Simulation Enable/Disable (AI2.SIMULATE_ENABLE) to Disabled.	RS DEVICE_ STATUS_3 bit13
AI2 Not Scheduled (AL-67)	AL-67	AI2 Block is not scheduled. (AL-67) [Remedy]: Make a schedule of AI2 Block.	RS DEVICE_ STATUS_3 bit12
AI3 in O/S Mode (AL-28)	AL-28	AI3 Block is in O/S mode. (AL-28) [Remedy]: Change the AI3 Block Mode. Target (AI3.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_5 bit27
AI3 in Man Mode (AL-77)	AL-77	AI3 Block is in Manual mode. (AL-77) [Remedy]: Change the AI3 Block Mode. Target (AI3.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_5 bit 23
AI3 Simulation Active (AL-78)	AL-78	AI3 Block is in simulation mode. (AL-78) [Remedy]: Change the AI3 Simulation Enable/Disable (AI3.SIMULATE_ENABLE) to Disabled.	RS DEVICE_ STATUS_5 bit22
AI3 Not Scheduled (AL-79)	AL-79	AI3 Block is not scheduled. (AL-79) [Remedy]: Make a schedule of AI3 Block.	RS DEVICE_ STATUS_5 bit21
DI1 in O/S Mode (AL-25)	AL-25	DI1 Block is in O/S mode. (AL-25) [Remedy]: Change the DI1 Block Mode. Target (DI1.MODE_BLK.Target) to Auto or other mode. In addition, check that Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_3 bit22
DI1 in Man Mode (AL-68)	AL-68	DI1 Block is in Manual mode. (AL-68) [Remedy]: Change the DI1 Block Mode. Target (DI1.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_3 bit10
DI1 Simulation Active (AL-69)	AL-69	DI1 Block is in simulation mode. (AL-69) [Remedy]: Change the DI1 Simulation Enable/Disable (DI1.SIMULATE_ENABLE) to Disabled.	RS DEVICE_ STATUS_3 bit9
DI1 Not Scheduled (AL-70)	AL-70	DI1 Block is not scheduled. (AL-70) [Remedy]: Make a schedule of DI1 Block.	RS DEVICE_ STATUS_3 bit8

Alarm item	Alarm No.	Description	Parameter
DI2 in O/S Mode (AL-26)	AL-26	DI2 Block is in O/S mode. (AL-26) [Remedy]: Change the DI2 Block Mode. Target (DI2.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_3 bit21
DI2 in Man Mode (AL-71)	AL-71	DI2 Block is in Manual mode. (AL-71) [Remedy]: Change the DI2 Block Mode. Target (DI2.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_3 bit6
DI2 Simulation Active (AL-72)	AL-72	DI2 Block is in simulation mode. (AL-72) [Remedy]: Change the DI2 Simulation Enable/Disable (DI2.SIMULATE_ENABLE) to Disabled.	RS DEVICE_ STATUS_3 bit5
DI2 Not Scheduled (AL-73)	AL-73	DI2 Block is not scheduled. (AL-73) [Remedy]: Make a schedule of DI2 Block.	RS DEVICE_ STATUS_3 bit4
Simulation Switch ON	-	Software or hardware simulation switch is ON. [Remedy]: Change the value of RB Sim Enable Message (RB.SIM_ENABLE_MSG) or turn off the hardware simulation switch.	RS DEVICE_ STATUS_1 bit23

Table A12.5 Others

Alarm item	Alarm No.	Description	Parameter
PID in O/S Mode (AL-27)	AL-27	PID Block is in O/S mode. (AL-27) [Remedy]: Change the PID Block Mode. Target (PID.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_3 bit20
PID in Bypass Mode (AL-74)	AL-74	PID Block is in Bypass mode. (AL-27) [Remedy]: Change the value of PID Bypass (PID.BYPASS) to OFF.	RS DEVICE_ STATUS_3 bit2
IT in O/S Mode (AL-29)	AL-29	IT Block is in O/S mode. (AL-29) [Remedy]: Change the IT Block Mode. Target (IT.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_5 bit26
IT in Man Mode (AL-80)	AL-80	IT Block is in Manual mode. (AL-80) [Remedy]: Change the IT Block Mode. Target (IT.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_5 bit19
IT Not Scheduled (AL-81)	AL-81	IT Block is not scheduled. (AL-81) [Remedy]: Make a schedule of IT Block.	RS DEVICE_ STATUS_5 bit18
IT Total Backup Err (AL-82)	AL-82	IT Total backup failed. Last IT Output.Value (IT.OUT.Value) could not saved. (AL-82) [Remedy]: Contact the nearest office or service center.	RS DEVICE_ STATUS_5 bit17
IT Conf. Err (AL-83)	AL-83	IT Clock Period (IT.CLOCK_PER) is smaller than IT Period of Execution (IT. EXECUTION_PERIOD). (AL-83) [Remedy]: Change the value as IT Clock Period (IT.CLOCK_PER) is larger than IT Period of Execution (IT.EXECUTION_PERIOD).	RS DEVICE_ STATUS_5 bit16
AR in O/S Mode (AL-30)	AL-30	AR Block is in O/S mode. (AL-30) [Remedy]: Change the AR Block Mode. Target (AR.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode. Actual (RB.MODE_BLK.Actual) is set to Auto mode.	RS DEVICE_ STATUS_5 bit25
AR in Man Mode (AL-84)	AL-84	AR Block is in Manual mode. (AL-84) [Remedy]: Change the AR Block Mode. Target (AR.MODE_BLK.Target) to Auto or other mode.	RS DEVICE_ STATUS_5 bit14
AR Not Scheduled (AL-85)	AL-85	AR Block is not scheduled. (AL-85) [Remedy]: Make a schedule of AR Block.	RS DEVICE_ STATUS_5 bit13
AR Range Conf. Err (AL-86)	AL-86	AR Range High (AR.RANGE_HI) is smaller than AR Range Low (AR.RANGE_LOW). (AL-86) [Remedy]: Change the value as AR Range High (AR.RANGE_HI) is larger than AR Range Low (AR.RANGE_LO).	RS DEVICE_ STATUS_5 bit12
AR Temp. IN Over Range (AL-87)	AL-87	AR Input1 (AR.IN_1) is over range. (AL-87) [Remedy]: This case is out of specification. Refer to IM, Check the engineering setting or AR Temperature Unit (AR.AR_TEMPERATURE_UNIT).	RS DEVICE_ STATUS_5 bit11
AR Press IN Over Range (AL-88)	AL-88	AR Input2 (AR.IN_2) is over range. (AL-88) [Remedy]: This case is out of specification. Refer to IM, Check the engineering setting or AR Pressure Unit (AR.AR_PRESSURE_UNIT) and AR Bias Input2 (AR.BIAS_IN_2).	RS DEVICE_ STATUS_5 bit10

Alarm item	Alarm No.	Description	Parameter
AR Flow IN NotConnected (AL-89)	AL-89	AR Input (AR.IN) is not connected to the volumetric flow. (AL-89) [Remedy]: Connect the volumetric flow data into AR Input (AR.IN).	RS DEVICE_ STATUS_5 bit9
AR Temp. IN NotConnected (AL-90)	AL-90	AR Input1 (AR.IN_1) is not connected to the temperature. (AL-90) [Remedy]: Connect the temperature data into AR Input1 (AR.IN_1).	RS DEVICE_ STATUS_5 bit8
AR Press IN NotConnected (AL-91)	AL-91	AR Input2 (AR.IN_2) is not connected to the pressure. (AL-91) [Remedy]: Connect the pressure data into AR Input2 (AR.IN_2).	RS DEVICE_ STATUS_5 bit7
AR Comp. Coef. Conf. Err (AL-92)	AL-92	AR Compensation Coefficient (AR.AR_FLOW_CONFIG.Element) changed unexpected. Therefore AR Output (AR.OUT.Value) is uncertainty. (AL-92) [Remedy]: Set the AR Compensation Coefficient (AR.AR_FLOW_CONFIG.element) again.	RS DEVICE_ STATUS_5 bit6
AR Output Unit Conf. Err (AL-93)	AL-93	AR Output Range. Units Index (AR.OUT_RANGE.Unit Index) is not selected rightly the corresponding to AR Arithmetic Type (AR.ARITH_TYPE) (AL-93). [Remedy]: Refer to IM or Check the AR Output Range. Units Index (AR.OUT_RANGE. Unit Index) and AR Arithmetic Type (AR.ARITH_TYPE).	RS DEVICE_ STATUS_5 bit5

Table A12.6 Additional Information

Alarm item	Alarm No.	Description	Parameter
Output of AI1		The primary value calculated as a result of executing the function in AI1	AI01. OUT
Total		Indicates the totalized value	AI01. TOTAL
Output of AI2		The primary value calculated as a result of executing the function in AI2	AI02. OUT
Output of DI1		The primary value calculated as a result of executing the function in DI1	DI01. OUT_D
Output of DI2		The primary value calculated as a result of executing the function in DI2	DI02. OUT_D

Revision Information

- Title: Model DY Vortex Flowmeter Model DYA Vortex Flow Converter Fieldbus Communication Type
- Manual No.: IM 01F06F00-01EN

Edition	Data	Page	Revised Item
1st	May 2003	-	New publication
2nd	July 2003		· Added appendix 7 (DeviceViewer) · Unification of alarm contents
3rd	October 2004		· Standardized the Link Master function. · Revised FM intrinsically Safe Approval.
4th	January 2005	1-2 3-2 4-1 4-2 4-3 5-1 5-2 5-4 6-3 8-1 9-1 9-4 A-13 A-39 A-40 A-42	· Added scriptions to “Safe Use of This Product”. · Revised a clerical error. · Revised descriptions and clerical errors. · Revised descriptions. · Revised descriptions and clerical errors. · Revised descriptions and clerical errors. · Revised clerical errors. · Revised a sentence. · Added descriptions. · Added descriptions. · Revised a sentence. · Revised sentences. · Added a description to “Tag numbers”. · Revised a Node address number. · Revised a Node address numbers and Figure A6-3. · Revised a description of “Default Factory Setting” of Index number 367.
5th	August 2008	3-1 3-2 4-2 4-3 5-6 5-7 5-9 5-11 6-1 6-2 6-3, 6-4 6-5, 6-6 6-7 7-2 8-1 to 8-3 9-1 to 9-5 A-1 to A-39 A-41 to A-60 A-71 A-80 to A-88 A-89 to A-96 A-98, A-99 A-99 A-105	· Addition and revision to 3.2.2 (2). · Added A13, AR and IT blocks into Figure 3.1. · Added DEVICE INFORMATION. · Revision of 4.4. · Revision of 5.6.4. · Addition into Table 5.11. · Addition into Table 5.12. · Addition into Table 5.16. · Correction of 6.1. · Addition into 6.3 · Correction of 5), 8), 15), 17), 20), 21). · Addition and revision to 6.4. · Addition and revision to 6.5. · Revision of Table 7.1. · Addition and revision to 8. · Addition and revision to 9. · Addition and revision to Appendix 1 to 3. · Addition Appendix 5 and 6. · Revision. · Added notes. · Added Appendix 10. · Revision. · Revision of A11.5. · Revision of Appendix 12.
6th	August 2012	9-3, 9-4 10-1, 10-2, 10-4, 10-5 10-6 10-11, 10-12 10-13	· Revision for Explosion proof · Revision for Explosion proof · Correction · Added IECEx · Revision for Explosion proof

Edition	Data	Page	Revised Item
7th	October 2013	Cover	· Addition of logos
		Contents	· Correction
		1-1 to 1-4	· Revision of Chapter 1
		2-1	· Correction of Chapter 2
		3-1 to 3-2	· Correction of Section 3.1 to 3.3
		4-1	· Correction of Section 4.1
		4-2 to 4-3	· Correction of Section 4.3 and 4.4
		4-4	· Correction of Section 4.7
		5-1 to 5-5	· Correction of Section 5.1 to 5.5
		5-7 to 5-14	· Correction of Subection 5.6.3 and 5.6.4
		5-13 to 5-14	· Addition of Table 5.16 and Table 5.17
		6-2 to 6-7	· Correction of Section 6.2 to 6.5
		7-1 to 7-3	· Correction of Section 7.2 and 7.3
		8-1 to 8-3	· Revision of Chapter 8
		9-1 to 9-5	· Revision of Chapter 9
		10-1 to 10-4	· Revision of Section 10.1
		10-5 to 10-13	· Correction of Section 10.2 to 10.4
		10-14	· Revision of Section 10.5
		A1-1 to A1-11	· Correction of Appendix 1
		A2-2 to A2-3	· Correction of Appendix 2.2 and 2.3
		A3-1 to A3-15	· Revision of Appendix 3
		A5-2	· Correction of Appendix 5.2.1
		A5-4	· Correction of Appendix 5.3.1
		A5-8	· Correction of Appendix 5.6.1
		A5-9	· Correction of Appendix 5.6.3
		A5-10	· Correction of Appendix 5.7
		A6-1	· Correction of Appendix 6
		A6-3	· Correction of Appendix 6.2.4
		A6-4 to A6-5	· Correction of Appendix 6.3.1 to 6.3.3
		A6-6	· Correction of Appendix 6.4.1 and 6.4.2
		A6-8 to A6-9	· Correction of Appendix 6.5
		A6-10	· Addition of Appendix 6.7
		A7-1	· Correction of Appendix 7.1
		A7-3	· Correction of Appendix 7.4
		A7-4	· Correction of Appendix 7.5.1
		A7-6	· Correction of Appendix 7.5.2
		A7-8	· Correction of Appendix 7.6
		A8-2 to A8-4	· Correction of Appendix 8.3 to 8.5
		A8-5 to A8-8	· Correction of Appendix 8.9 to 8.17
		A10-1 to A10-8	· Correction of Appendix 10
		A11-1 to A11-2	· Correction of Appendix 11.2 to 11.4
		A11-4	· Correction of Appendix 11.8
		A12-1 to A12-5	· Revision of Appendix 12